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Acetylene for Light and Fuel.—A gross ton of carbide will yield about 9,400 cubic feet of acetylene at a cost very slightly above $32.76, as the final formation of acetylene is practically without expense. Nine thousand four hundred cubic feet of coal or water gas costs the consumer somewhere between $14 and $16, roughly about one-half as much as the same amount of acetylene. But as acetylene gives over eight times as much light per cubic foot, a large margin seems to be left for decreased gas bills to the consumer and increased profit for the producer. On the whole, then, it may be said that acetylene promises to be an important rival of the present methods of illumination, and deserves the careful examination of both the consumer and manufacturer of light-givers. It has been proposed to use calcium carbide as a concentrated fuel on war vessels and in places where space is more important than cost. Dr. Frank has made the following calculation of the gain in space over coal: To provide power for a 1,000 horse marine engine for 25 days would require 413 tons of coal, occupying a space of about 1,500 cu. ft. In this space could be stored enough of the carbide to propel the ship at the same rate for 75 days. In other words, as a fuel one ton of carbide is equal to three tons of coal. There are works engaged in the manufacture of calcium carbide at Spray, N. C., at Niagara Falls and at Lockport, N. Y.; in Europe, at Betterfield, Prussia. at Neuhausen, Switzerland, at Baden, in Germany, and at Troyes and Valorbes in France. —[V. J. Youmans in Appleton's Popular Science Monthly for October.

New Method to Harden Iron.—For the hardening of articles of wrought iron hitherto only one preparation has been known, ferrocyanide of potassium. The principal drawback of hardening with ferrocyanide of potassium is that it is not uniform in its operation. This drawback, it is claimed, is entirely obviated by a new preparation which has been devised by Dr. Graf, a chemist of Friedrichsberg, and which has been taken up by various authorities in Central Europe. It differs from the usual dry compounds by being in liquid state, and this is esteemed to be its chief advantage, as by spreading it on with a brush the article or part to be hardened receives a uniform coating of the material. Owing to the peculiar composition of the liquid it possesses the quality of stiffening into a mass as hard as stone within a few seconds of its application. The same chemist has discovered a compound for the hardening of steel.

Calcutta's Docks.—Among the most notable systems of dock construction achieved by modern engineering science, Calcutta may be said to present a conspicuous example. The entrance to these docks is through a channel 80 feet wide, and a lock 60 feet wide, terminating in a basin measuring 600 by 680 feet. Two entrances, 60 and 80 feet wide, lead from this basin to the dock proper, which is 2,600 feet long, 60 feet wide for the greater part of its length, and covers thirty-four and a half acres, two dry-docks also leading off from the basin, one of them 520 feet long and the other 350 feet. While the river is low these waterways are supplied with fresh water from the neighborhood, and elaborate provision is made to remove the mud from this water before it is pumped into the basin. The docks are equipped with fifty-six movable hydraulic cranes, of which fifty are constructed to move as much as one and three-fourths tons, while the remainder can handle weights of five tons, all of them overhanging the quay twenty.nine feet, and operated by water under pressure. as are also the lock gates, capstans and swing bridges about the docks. The water is under a pressure of 700 pounds and is furnished by two pairs of hydraulic engines, each of 230 horse power.

Railroad Taxes.—In the annual report of the Erie Railroad Company President Thomas notes with some concern the growing tendency of the states, counties, cities and towns along the railroad to increase the taxes levied upon the property, both by higher valuations and greater rates, and in some cases by practically double taxation, for the property itself is taxed and its earnings are taxed. It will no doubt be a surprise to be informed that for the seven months covered by this report the taxes paid by the company amount to more than 3⅛ per centum of its gross earnings, yet such is the fact, and estimates for the current fiscal year indicate that at least as great a portion of revenue will go to the tax gatherer. It is quite proper that railroad corporations should contribute their fair share towards the support of the various state and municipal governments whose protection they enjoy, but there seems to be an idea abroad that it is thoroughly legitimate to require a railroad company to make good the deficit of the town treasury or to serve as a general rate reducer by submitting to exorbitant assessments. No property brings greater benefits to a community than the railroad, and for this, if for no other reason, municipal officers should deal fairly with it in levying their assessments.

Mexican Patent Regulations.—The congress of the Mexican Republic, by decree has amended article 33, chapter 5, of the law of June 7, 1890, relating to patents of inventions, in certain particulars. The proprietor of a patent or invention or improvement is obliged to prove to the minister of commerce and industry (Secretario de Fomento) at the end of every five years whilst the patent lasts, and in order to keep it in force for a further five years, that he has paid to the treasury at the termination of the first five years the sum of $50 as an additional fee; at the end of ten years the sum of $75, and at the end of 15 years the sum of $100. All these payments must be made in Mexican dollars. The time during which it must be proved that these payments have been made is limited to two months after the expiration of the period of five years, and such time shall not be extended. Those persons interested who up to the date of promulgation of this law may have become subject to the forfeiture established in the third paragraph of article 37 of the law of July 7, 1890, may avail themselves of the provisions of this law in order to relieve themselves of the liability of forfeiture, provided that they duly pay the fees within three months from the date of promulgation thereof, and without prejudice to the rights which third parties may have acquired after the declaration of the forfeiture.

Steel vs. Wooden Cars in Europe.—In the Kingdom of Prussia, where about nine-tenths of all the railroads have been bought, and are now owned by the government, together with extensive car shops, a good opportunity was offered to settle the long discussed question as to the relative merits of wood and steel cars for railways. The Royal Niederschleisische Maerkische Railroad, between Berlin and Breslau, is the trial field for any novelty to be introduced in the construction of the government's railroad or rolling stock, and here on the Rechte Oder Ufer Railway the most practical and best built cars, entirely of iron and steel, have been in use for a number of years. Minute and strict data have been kept of these metal cars, and also of the wooden cars, constructed and equipped at the same time, having the same capacity and being employed for the same service. After a period of about five years the data thus obtained proved that the wooden cars are less damaged than metal ones. Moreover, the damages to the metal cars were not only more serious, but required in every instance the sending of the cars to the shops for repairs, while the damaged wooden cars could, usually, be repaired at the place of accident, thus effecting a large saving in the maintenance item. The wooden cars also are the cheapest, and in view of the above facts it appears future construction will be limited to them.

Straightening a Chimney Stack.—The accomplishment of a job of this kind is a very ingenious way, at the brick and and tile works of the Standard Concrete Manufacturing Co., Earnest, Pa., under the supervision of Mr. B. W. Seamans, the company's superintendent, is described by Engineering News. The stack is 122 ft. high, 11 ft. square at the base, tapering somewhat at the top, and weighs 400 tons. The walls are 36 in. thick. The top was found to be leaning 45 in. from a vertical line. To sink the side 4½ in., 10½ in. of brick work was removed from the foundation on three sides. As the bricks were removed square blocks of wood were inserted one after the other, until three sides of the stack rested on the blocks. Between the blocks, supporting the stack temporarily, substantial brick piers 6 in. high were built, leaving a space 4½ in. between the top of the piers and the bottom of the undermined brick work. The blocks were then set on fire and all were kept burning briskly. If one burned faster than the others the fire on that particular block was checked, so that all were made to burn uniformly, and as the blocks were being reduced to ashes the stack slowly righted. As the top gradually swung back through the 45 in. arc small fissures appeared near the base. Into every crevice a steel wedge was driven, maintaining the solidity of the walls. The entire work consumed one day, and the reduction of the wooden blocks to ashes required an hour.

Teredo-Proof Paint.—The commission appointed by the secretary of the navy to test a teredo-proof paint invented by Thomas J. Childerson, a painter at the Pensacola navy yard, has concluded its labors. On March 16 four pieces of solid heart pine wood were sunk at the navy yard. One piece was unpainted and the others had one, two, and three coats of the teredo-proof paint respectively. At noon on September 15 the three members of the commission assembled, and had the four pieces of wood raised. The piece that was not painted was literally honeycombed by the teredo, and fell to pieces. The other three pieces were not touched by the insects, and were perfectly dry on the interior. The commission considers the invention a perfect success, and one that will be of vast interest to the government and ship owners. Their report has been forwarded to Washington.

Iron vs. Wood Sleepers.—In the current issue of the Bulletin of the International Railway Congress, Mr. W. Hohenegger describes his experiences with two experimental sections of line laid with longitudinal sleepers of wrought iron. These sleepers were of channel section, and were made in lengths of 31 ft. 10 in., their weight being 52 lbs. per yard. The rails weighed 54 lbs. per yard, and the gage of the line was maintained by simple angle connections at about every ten feet. The final cost of the track as laid was 1*l*. 7s. 4d. per yard as against 1*l*. 8d. for ordinary track with wooden sleepers. One of the sections laid has just been taken up after 20 years' use and is to be replaced with a similar but heavier track. During the whole period there has not been a single rail or sleeper fracture on either of the experimental sections laid, and the life of the rails has been from five to eight years more than on the adjoining sections laid in the ordinary manner. In addition to these two experimental sections, other portions of the line have also been laid with longitudinal sleepers, steel being used in the latest designs, in which the weight of the sleepers is 60 lbs. per yard. The cost of this track is 1*l*. 4s. 4d. per yard, and in all some 43½ miles of it have been laid. The rails and the sleepers break joint, this being found to give a better track than coincident joints. The experience gained is said to have been of a satisfactory nature.

Small Economies.—Although success in business depends very largely upon small economies, it by no means follows that whoever practises small economies will be successful. There are indeed forms of economy which are disastrous in business. The "penny wise" man is often made a "pound foolish" one by his ideas being contracted, owing to their absorption in petty savings to such an extent that he is unable to see where, by spending his "pound," he can secure more pennies than he can save in a long period; or as a Chicago manufacturer once, in a more homely phrase, expressed it: "He keeps a one-dollar bill so close to his eyes that he can't see a ten-dollar bill within arm's length of him."

Electricity on the Lake Street Elevated, Chicago.—The second change from steam to electric traction on the Lake Street Elevated Railroad of Chicago was made at midnight of September 20, and the new apparatus has, with a few exceptions, worked admirably. Some slight difficulties were experienced in attempting to run trains at 2½ minute headway, but all things considered the change has been carried out with good success. This experiment will be watched with interest because of the fact that from carefully kept records while the road was operated by steam locomotives, a comparison of the two systems of traction may be made upon an intelligent basis. The general superintendent of the road, Mr. F. Hedley, will be in a position to state exactly the difference in cost of operation effected by the introduction of electricity, and while there is no doubt in any mind as to the outcome, the extension of electric traction to roads upon which it is applicable, at least in the neighborhood of Chicago, will depend largely upon the results of the comparison of operating expenses in this case.

UNIT STRESSES FOR TIMBER.

Under the caption "The Proper Unit Stresses for Timber" Mr. F. E. Kidder writing in the Inland Architect and News Record gives a comparison of recommended unit stresses with those fixed by law which is of interest as showing the wide differences between the constants for the strength of timber in use in bridge and building construction. It also indicates the desirability of a uniformity of practice in this matter. The communication is reproduced in part as follows:

Although, for two hundred and fifty years, timber has been the common constructive material for buildings in this country, it has only been within a comparatively few years that any serious steps have been taken toward its economic and scientific use. As near as the writer can ascertain, the size of timbers used in building construction previous to the year 1877, when Mr. R. G. Hatfield published his work on transverse strains must have been determined almost entirely by guesswork or by former experience.

It is true that Mr. Peter Barlow, in 1817, published in England an "Essay on the Strength of Timber," in which work correct formulas for the strength of beams were first given, as well as the coefficients for the strength of various woods. These data were copied in works on building construction published during the next 50 years, but it is very doubtful if much use was made of them in this country.

Mr. John C. Trautwine was probably the first one in this country to give practical rules and coefficients for the strength of timber, and for many years his "Engineer's Pocket Book" was the standard work, among practical men, on the strength of materials. All the early experiments made to determine the coefficient, or what is now termed "fiber stress," for the strength of timber beams were made on very small pieces, and as greater intelligence began to be displayed in building construction, a general distrust arose as to the practical value of these results and since 1880, many tests have been made on full size timbers, so that we now have a great deal of valuable data relating to the strength of all kinds of framing timber used in this country.

The regulating of building construction by municipal ordinances and state laws, and the increasing tendency of holding the architect responsible for the safety of all construction designed by him, is also doing much toward insuring a more scientific use of building materials.

There is still, however, too much variation in the constants given in various works for the strength of timber, and the custom now prevailing of inserting in building ordinances or laws minimum unit stresses for structural materials makes it especially desirable that a uniform standard shall be established which shall fix a limit that will be perfectly safe for timber of a fair quality, and at the same time not require an undue amount of material.

There is, of course no reason why a given beam will not carry as great a load in one city as in another, and the great variation in the unit stresses for timber given in recent building ordinances certainly does not reflect to the credit of the class of persons who are responsible for them.

The most thorough work that has yet been done in this direction is that of the committee on "Strength of Bridge and Trestle Timbers," of the Association of Railway Superintendents of Bridges and Buildings, as evidenced in its report presented at the fifth annual convention of the association held in New Orleans, October 15 and 16, 1895.

This report is a very exhaustive resume of all published tests that have been made on American lumber, as well as the recommended values of authors and structural engineers. The report fills 49 closely printed octavo pages, and contains a great mass of valuable information on the subject.

As a result of the investigation of this committee, standard unit stresses were recommended for all varieties of timber used in bridge work at the present day. That these standards will have great weight with engineers, and even, if necessary with the courts cannot be questioned. As further evidence of an increasing interest in this direction the report of the proceedings of the twenty-ninth annual convention of the American Institute of Architects contains two very valuable papers on the strength of timber, one by Geo. W. Bullard, of Tacoma, Washington, and the other by Prof. J. B. Johnson, of Washington University, St. Louis.

In deciding on standard unit stresses for building construction several considerations besides that of actual strength, as determined by experimental tests, should be taken into account; the most important of these considerations is that of load. When the load is taken at from two to five times what the real load is ever likely to be, it is evident that a higher unit stress may be allowed than when only the actual load is provided for. Thus, the building laws of Boston, New York and Chicago require that the floor joists in dwellings shall be computed to sustain a load of 70 lbs. per square foot of floor, in addition to the weight of the floor construction. This is certainly three times as great as the actual loads, and the writer doubts if a single case can be found where there is, or even has been, a load of 30 lbs. per square foot for the entire floor area of a single room when used as a dwelling or for lodging purposes. In roofs it is generally customary to figure on loads that are about twice those which actually occur in winter.

On the other hand, some allowances must be made for the unavoidable cutting of timbers, and for a variation of the actual depth and thickness of beams from that assumed. The writer believes that where beams carry constant full loads, as when supporting a brick wall, a lower unit stress should be used than for ordinary floor loads. A lower unit stress should also be used for timber that supports machinery.

For floor beams, where the span in feet exceeds the depth of beams in inches, the writer believes that the safe load should be determined by the formulas for stiffness, and that such provision should be made in the building laws.

The various unit stresses which the writer has finally adopted for the more common framing timbers are given in the following table, which has been compiled so as to show the standards set by the later building laws, and also those recommended by the committee of the Association of Railway Superintendents of Bridges and Buildings, and by Mr. A. L. Johnson, civil engineer, in charge of physical tests of United States Forestry Division. It may be stated that the values given in the tables opposite "Association of Railway Superintendents" are based on a factor of safety of five for tension and compression, and four for transverse strength and shearing. For bridges, the committee recommends a factor of ten for tension, five for compression, six for transverse strain, and four for shearing.

LONG LEAF YELLOW PINE.

Authority or Ordinance.	Transverse Strength A.	Crushing. With grain. C.	Crushing. Across grain. C.	Shearing parallel with grain. F.	Tension T.	e.
Boston	69	1,000	250	100	.....	100
Buffalo	100	1,000	.....	.....	.....	.....
Chicago	80	900	.....	.....	.....	.....
New York and Brooklyn	137	1,000	.....	.....	.....	.....
Assoc. of R'y Supts*...	97	1,000	350	150	2,400	132
A. L. Johnson*.....	107	1,000	645	125	2,400	111
Kidder.....	100	1,000	500	125	2,000	137

WHITE PINE.

Boston	42	625	150	80	.....	58
Buffalo	60	700	.....	.....	.....	.....
Chicago	50	600	.....	.....	.....	.....
New York and Brooklyn	112	700	.....	.....	.....	.....
Assoc. of R'y Supts*....	55	700	200	100	1,400	77
A. L. Johnson*.....	61	700	440	75	1,400	67
Kidder.....	60	700	200	80	1 400	82

WHITE OAK.

Boston	55	750	250	150	.....	66
Buffalo	75	800	.....	.....	.....	.....
Chicago	60	800	.....	.....	.....	.....
New York and Brooklyn	137	.....	.....	.....	.....	.....
Assoc. of R'y Supts*....	83	900	500	200	2,000	85
A. L. Johnson*.....	83	800	1,200	200	2 000	85
Kidder.....	75	800	600	150	2,000	95

SPRUCE.

Boston	42	625	150	80	.....	69
New York and Brooklyn	112	700	.....	.....	.....	.....
Assoc. of R'y Supts*....	55	800	200	100	1,600	92.6
Kidder.....	70	800	250	90	1,600	100

OREGON PINE (DOUGLAS FIR).

Assoc. of R'y Supts*....	90	1,200	300	150	2,000	108
A. L. Johnson*.....	91	880	500	150	.....	106
John D. Isaacs†.....	..	.....	1,200	400	.....	1,600	98
Kidder.....	90	900	400	150	1,800	110

*These values are 1-5th the ultimate stress for tension and compression, and ¼th for beams and shearing.

†Values used for bridge work on Southern Pacific Railway.

A—Safe center load, in lbs. for beam 1 in. square and 1 ft. span.

C, C, F and T—lbs. per square inch of section.

e—Coefficient formula: def. in formula $S = \frac{b\,d^3\,e}{L^3}$; obtained by dividing modules of elasticity by 12,960.

Comparing the values as found in the building laws, it will be seen that Boston and New York represent the extremes, the values for transverse strength in the New York law being twice those given in the Boston law. If the Boston law is strictly enforced, which the writer very much doubts, the floor joists in that city must be very heavy indeed. The New York values, although higher than the writer recommends, when taken in connection with the requirements for floor loads, are not far out of the way, as far as they apply to floor beams. For beams supporting walls, etc., they are obviously too high.

Of all the building laws passed up to the present time, the writer believes that the Buffalo ordinance is the most nearly perfect as far as it relates to the strength of materials and to floor loads. It is certainly most nearly in accord with the practice of leading structural engineers.

It should be noticed that the values recommended by the railway superintendents and individuals agree, in general, very closely.

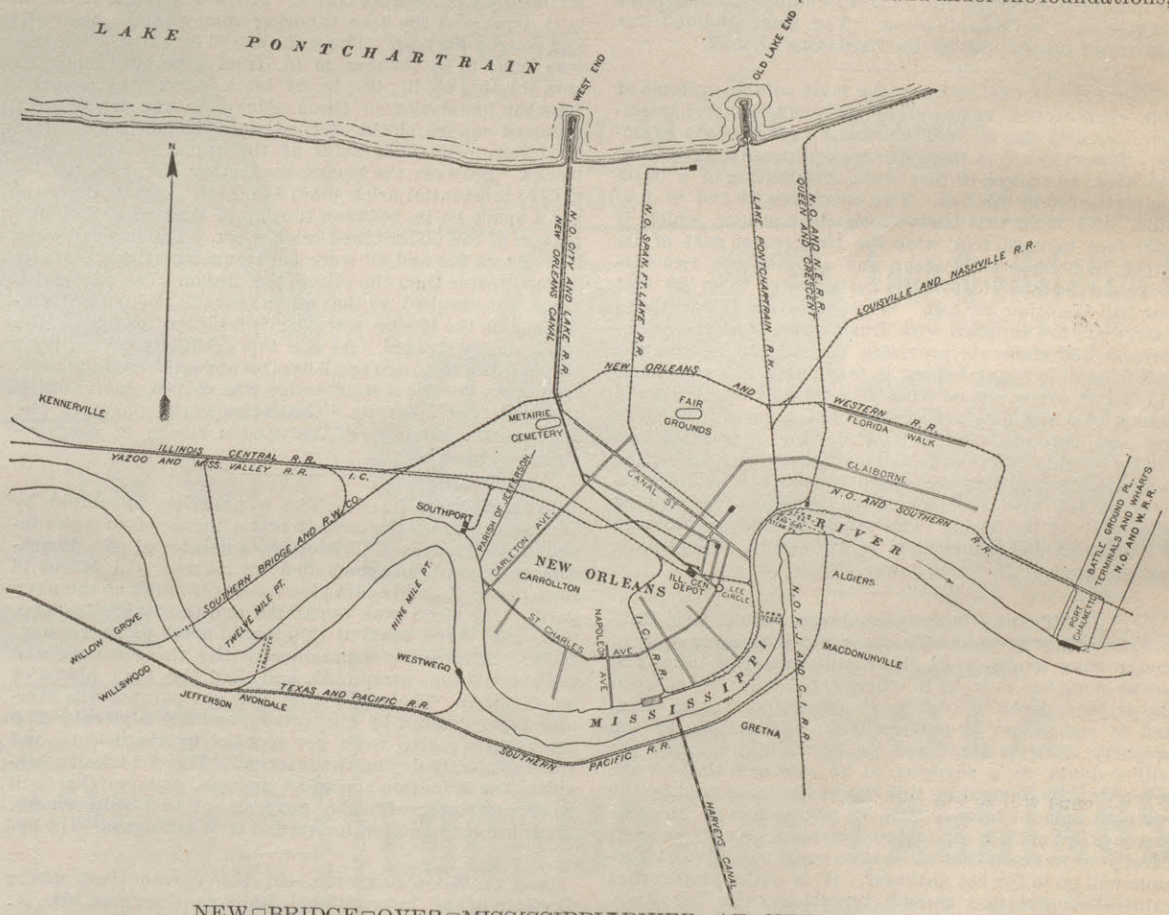
The Boston law is the only one that fixes values for the modulus of elasticity, and even this does not require that beams shall be calculated by the rules for stiffness.

It would seem that, with the data now available, standard unit stresses might be adopted which would be uniformly recognized throughout the country.

NEW BRIDGE AT NEW ORLEANS.

The project of bridging the Mississippi river at New Orleans has attracted a great deal of attention, and details of the plan have been looked for with interest. The following portion of a description of the structure by Mr. E. T. Corthell chief engineer, is reproduced from the Manufacturers' Record:

"The project for a bridge had its inception in the year 1888. After several years of attempts to obtain the legislation from congress, a charter was granted the general terms of which were that it should be located above the city of New Orleans, and within five miles of it; that the main channel span should be 1,000 feet long in the clear at low water, and the hight in the clear eighty-five feet above extreme high water. Careful investigations to find the most suitable place for a bridge resulted in a location between four and five miles above the city limits. The plans, based on the requirements of the charter, were presented to the secretary of war and were approved by him. The location of the bridge is shown upon the outline map; also its approaches and its connections with the four railroads, two upon each side of the river.



NEW BRIDGE OVER MISSISSIPPI RIVER AT NEW ORLEANS.

"It was necessary to adopt the cantilever plan, as an independent span 1.000 feet long was not considered practicable, at least, desirable, and as the ground is so low and no rock exists in the entire country for anchorage, a suspension bridge was not practicable. The surface of the gronnd is about 100 ft. below the grade of the bridge and several feet below the surface of the water at high river. It is preserved against overflow by levees on each side. The river at the location is about 2,400 feet wide. a little less than half a mile. The entire length of the bridge and its approaches between the connecting points of the railroads on each side is about six and one-half miles. The length of the steel structure is a little over two miles, making it the longest in the world.

"The channel span will be 1,070 feet between centres of piers, or 1,044 feet in the clear at low water. It will be formed of two cantilever arms, each reaching out 270 feet from the piers and supporting a central span 530 feet long; the shore spans which act as anchorages of the cantilever arms are about 600 feet long; they are of such length and width that there will never be under any position of trainload any uplift at their shore ends. The outline of the top chord of the main bridge has been designed in graceful curves, rising from a hight of eighty feet above the track at the centre of the main span and ends of the shore spans to 160 feet above the river piers. On these piers are erected massive steel towers, formed of four posts firmly braced together.

"There are many important and interesting questions connected with the placing of foundations, that must firmly and permanently support such an immense structure, which will weigh about 23,000,000 lbs. in addition to the weight of the piers. The question becomes all the more interesting when it is known that nowhere in the alluvial basin of the Mississippi does there exist any bed-rock within a reasonable distance below the surface of the water, and still another very interesting question arises how best to place foundations in water about 100 feet deep at low water, with a range between high and low water of about nineteen feet. Careful examinations have been made at the site of the bridge to determine the character of the material beneath the river bed; fortunately, there were very satisfactory results from these examinations. From a point about fifty feet below low water there is found a clean, fine sand, and as the depth increases the sand becomes sharper and coarser, and nothing but sand is found; no clay in strata or pockets. The examination extended to about 200 feet below low water. It is generally known that bed-rock is scarcely more unyielding than clean, sharp sand, or even quick sand, if the sand is confined absolutely that is, prevented from spreading laterally. The problem is, therefore, confined to simply securing a foundation in this clean, sharp sand at such a depth as to place the foundations beyond all possibility of scour, and to make them of such size that the increased pressure upon the sand under the foundations, due to the superimposed weight, will not be excessive.

"One hundred and seventy feet below low water has been fixed upon as the base of the foundations of the two main piers. The increase in pressure caused by the structure, or what is called the "fatigue weight," will not exceed 7,000 pounds per square foot, and it will be necessary to make the area of base of these two river piers about 6,600 square feet.

"Caissons built of yellow-pine timber, firmly braced together, will support the masonary pier. The size of this caisson will be about 126 feet long and 60 feet

wide and will be 140 feet high. The caissons will be designed so that either one of two methods may be employed to sink them to their resting place, either by pumping out the sandy material of the bed by hydraulic process or by dredging it by the dredging process through wells built in the caisson and also in the masonry above the caisson. It is expected, however, that unless obstacles in the way of drift logs or wrecks of boats are encountered, the hydraulic process will be successful. The caissons will be fitted with a large number of pipes leading from the top, and the sand will be pumped up very much as it is in the ordinary process of sinking artesian wells through such materials. The details for providing for both processes are fully worked out, and it may be stated here that detail plans have been made, even to making bills of timber and iron for the entire structure of the foundations, as well as of the masonry.

"The masonry piers resting on the caissons begin thirty feet below low water and rise ninety-six feet above this level. The masonry of these river piers will be twenty feet by fifty-four under the coping. They will be rectangular in shape from the top to within a foot of the high-water line, from which elevation to the timber work there will be a cut-water or starling, on both up-stream and down-stream ends. The shore piers will be sunken either by the hydraulic process above described or by the plenum-pneumatic process, so well known to bridge engineers. The two shore piers, as they carry but little weight, will be much smaller than the main piers; they will be ten feet by fifty feet under the coping. The face stone of the piers will be of granite, the backing of concrete; the open wells of the main pier will be faced with brick. It is intended, in order to avoid any scour around the foundations of the river piers, to place about them on the bed of the river a willow mattress, extending 100 feet out from the foundations on each side, 100 feet down stream and 160 feet up stream; it will be heavily rip-rapped, and all scour will thus be prevented over this large area. The banks in the neighborhood of the bridge will also be protected from any scour which might cause a change in the present channel and shore line.

"It will at once be seen that a bridge, the track of which is placed 110 feet above low water will, with such low-lying lands, require very long approaches, if the grade to reach the bridge is a reasonable one. This grade will not be over 1½ per cent. The spans, ordinary deck truss spans of about 120 feet in length, and about 2,500 lineal feet of plate girder spans, are supported on steel towers, these towers resting on brick or concrete piers.

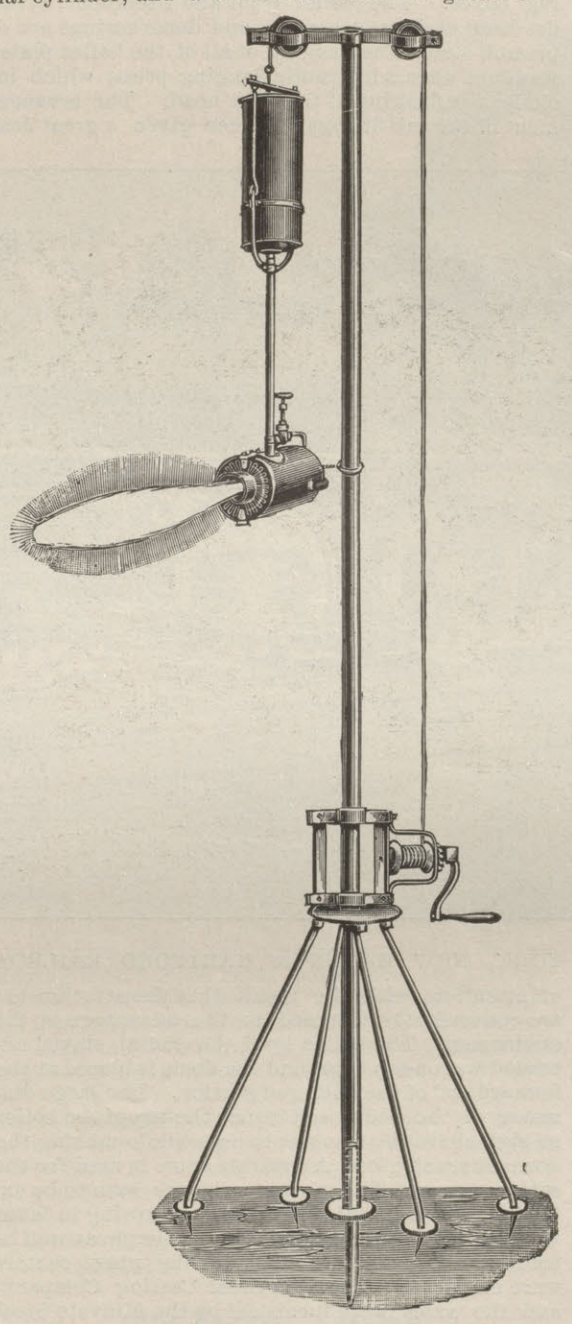
Nearly two years have been employed in working out the details of this immense structure, which is, in its proportions, far beyond any that has ever been built in the United States in the way of cantilever structures, and in some of its important features is entirely novel, especially in regard to the depth of water and the underlying material for the foundations. With the exception of completing some important details of the great cantilever structure, the entire work from the earth approaches on either end is ready for the construction work."

A POWERFUL PETROLEUM LIGHT.

In visiting a large railway shop recently, some experiments were noticed which are being carried out in connection with a petroleum light, which seems to possess valuable features for such work as wrecking and out door construction on railways as well as the illumination of the interior of buildings. This is known as the Durr light, and it is manufactured by Messrs. Lugwig, Durr & Co., of Bremen, Germany, from whom circulars have been received describing the apparatus in a general way. The light is compact and may be arranged in a variety of ways for the different purposes for which light is required, a convenient form for railway purposes being shown in the accompanying illustration. This apparatus consists of a tank containing the supply of oil which is removed sufficiently from the burner to avoid all danger of fire from the flame. The illuminant is ordinary lamp petroleum which is conducted by drops into a burner of peculiar construction, the details of which are not shown in the engraving. The burner must be heated for about five minutes by means of oil which is burned in small heating pans furnished with the apparatus. Behind the burner from which the flame issues, there is a second burner which, after the heating pans have been removed, continually produces the vapors and heats them to a high temperature at the same time completely surrounding the first burner with a strong flame. This arrangement is stated to make extinction of the light almost an impossibility even in the strongest wind. Fresh air is drawn in between the burner and the external cylinder by the force of the flame rushing out, and by using this air in the burner, a smokeless flame is produced on account of the air supply being heated.

The weight of the apparatus is 48 lbs. The oil used is ordinary 100 deg. coal oil, the consumption of which is about 1¾ pints per 1,000 candle power per hour. The flame is of gas and the oil as such never reaches the burner. The lamp requires no attention except refilling at the end of about seven hours, and as this may be safely done without extinguishing the flame, no interruption is caused by replenishing the supply. Mr. Richard J. Leupold whose office is in the Equitable building, Baltimore, Md., represents the manufacturers in this country, and from him some interesting records have been received of tests made by the British war office at Chatham, from one of which the following quotation is made:

"It may be explained that the light is originated by automatic evaporation and overheating of the vapors from ordinary lamp petroleum. Air is drawn into the lamp between the gasificator and the external cylinder, and a smokeless flame of great brilliance is produced. In short, vapors from the petroleum (stored in a reservoir above the burner) are produced by intense heat and converted into gas, which, upon being burned, yields a light ranging from 3,500 to 14,000 candle power. The apparatus is self-acting and does not necessitate the employment of compressed air. It is so constructed that a lamp and reservoir capable of holding ten liters of petroleum, and supplying a 3,500 candle power light, can be strapped on the knapsack of a soldier; and, what is more, the lamps can be carried about when burning or they can be fixed in any position required. The inventor claimed for the Durr light that its strong white flame would be scarcely affected by the heaviest winds or rain; and, at the request of Sir John Ardagh, the reservoir was refilled with petroleum while the light was burning, without the least interruption to the experiment. The trials, which were the first that have taken place in England, tended to establish the Durr light as an important auxiliary illuminant for military purposes. It would undoubtedly be of great value in innumerable instances in which lighting by electricity or gas is impracticable; and it has advantages over both these by reason of the facility with which it can be transported, handled, and brought into immediate use. In the embarkation or disembarkation of troops and the loading or unloading of store ships or transport wagons at night time it would be of the greatest possible service."

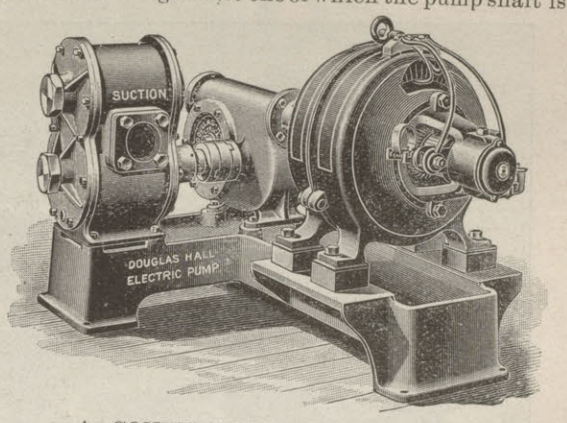


AN OUT DOOR PETROLEUM LIGHT.

A CONVENIENT ELECTRIC PUMP.

The electric pumping combination which is shown in the accompanying illustration has been designed particularly for maintaining a supply of water for house purposes, operating hydraulic elevators or for any service in which it is desired to elevate or distribute water. The manufacturers of this apparatus were among the first to adapt the pump to the electric motor, and the combination shown represents the result of an extended experience in this line of work.

The combination is known as the Douglass-Hall electric pump. Any form of electric motor can be used with the pump, that shown in the illustration being of the Lundell type. To the shaft of the motor armature a two-part worm combination is coupled direct, one helix being right, and the other left handed; these mesh with two gears, to one of which the pump shaft is attached. By means of this double worm gearing the end thrust of the worm is entirely overcome. The pump is of the rotary gear type, the action being similar in principle to that of the well known Root blower. There are two wide gears each having twelve deep teeth, the driving gear being of brass and the other one of hard rubber. This, it may be remarked, is one of the oldest types of water pumps, its invention dating from the sixteenth century. In its original form a serious objection was encountered from friction and constant wear, due to the reaction of the discharge pressure. In the present type this pressure is balanced by means of ports or radial openings between the teeth, and extending through the gears, the discharge pressure being thus made to act on both sides of the gears, thereby perfectly balancing them. Owing to this ingenious method, the gears are subject to no grinding wear against the suction side of the gear case, and the bearings will run true indefinitely.



A CONVENIENT ELECTRIC PUMP.

The pumping outfit includes an automatic starting rheostat operated by an electrical device at the receiving water tank. The pump described is the invention of Mr. M. W. Hall, and is manufactured by the W. & B. Douglass Co., 87 John street, New York.

CORRIDOR CARS IN ENGLAND.

It is stated by "Transport" that the two cars which Her Majesty, the Queen of England, has used for many years in her journeys from Windsor or Osborne to Ballater have been reconstructed by the London & Northwestern Railway Company. These cars have been united so as to form one saloon 60 ft. in length and entirely new running gear has been provided which makes use of two 6 wheeled trucks similar to those now in use on the latest dining cars on the West Coast Route. It is said that the object of the reconstruction was to obviate the necessity for stopping the royal train at certain fixed points on the journey in order to allow Her Majesty to proceed with comfort from the drawing room to sleeping room. It is interesting to see that the necessity for communication throughout the length of the train is becoming more and more appreciated in England and in view of the arguments presented in the following paragraph quoted from Transport it would seem as if the question of communication between cars might be considered a live one.

"The question of outrages in railway carriages is still attracting widespread attention. A lady writes declaring that it is not only timid and nervous

women that feel afraid of railway traveling under existing conditions. 'I have,' she says, 'traveled for a good many years, and have never experienced the slightest annoyance. But I am none the less aware of the risks which I, in common with every woman, run from the possibility of associations with ruffians, criminals, or drunken men. It is not merely the lunatic or the habitual criminal that one has to fear; it is any man whom drink or other exciting cause has for the moment deprived of self-control. Every woman who has travelled at all has painful memories of scares in railway carriages, and however little these scares may have been justified by actual annoyance, the rememberance is far from pleasant. I recollect setting off once for a holiday with a lady friend from a large terminus. We secured an empty third class carriage, and just as the train was starting two men, evidently tipsy, jumped in. It was too late for us to change, and I shall always carry in my mind the image of the lengthening faces of the friends who had come to see us off, as the train steamed slowly out of the station. Fortunately our tipsy companions slept peacefully; but if they had chosen to make themselves unpleasant I don't know what we should have done, for they could easily have prevented us from getting to the communicating cord. On another occasion I had to travel northwards from London by a midnight train. There was a very limited third-class accommodation in my part of the train, and the only part available contained two young soldiers, evidently rather fresh, and another man. I appealed to the guard, who placed me in an empty compartment—third or second I forget which—going part of the way in the right direction. This was labelled 'Ladies Compartment,' and the guard undertook to call me when I had to change. Thus I travelled comfortably; but I am an old hand, and know that an appeal to the guard (even, to his credit, without a tip) is seldom in vain. Suppose, however, that in my place had been a young servant or shop girl, or even a timid governess or a girl unused to traveling. She would not venture to call up the guard and would simply accept whatever accommodation she found. Actresses, musicians, and other women whose professions involve evening engagements are particularly exposed to risk, though for the matter of that the worst outrages have, as far as my memory serves me, been committed in daylight. Nor does it matter whether a women is young or old, plain or pretty, for robbery is sufficient cause for violence in any case, and sometimes the outrage seems to be motiveless except for the criminal instinct prompting to violence or blackguardism."

ANSWERS WANTED.

1. If the government should buy fifty-three cents worth of gold and stamp it "one dollar," *without making the coin legal tender*, would that make the value of the coin one dollar?

2. If the government should buy fifty-three cents' worth of gold and stamp it "one dollar," *making the coin legal tender*, would the silver men object?

3. Would the silver men be satisfied if the government stamped fifty three cents' worth of silver "one dollar," *without making the coin legal tender?*

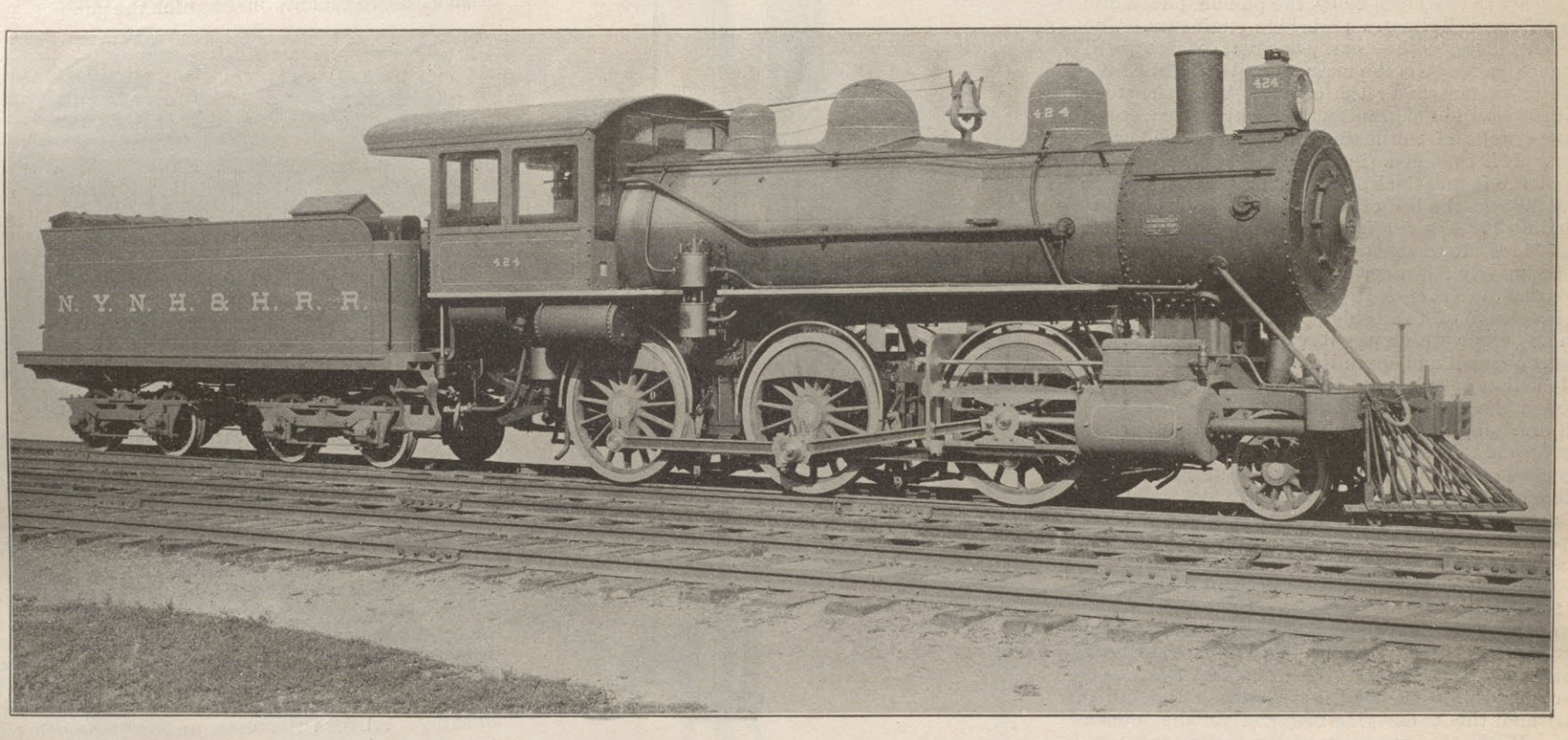
4. Why would it not be as reasonable to make fifty-three cents worth of gold "one dollar," as to make fifty-three cents worth of silver "one dollar"?—[L. A. W. Bulletin.

MOGUL FREIGHT LOCOMOTIVES—N. Y., N. H. & H. R. R.

The New York, New Haven & Hartford Railroad has just received ten mogul freight locomotives from the Schenectady Locomotive Works, one of which is shown in the accompanying illustration. These locomotives are designed in accordance with what may be considered a prevailing tendency to provide an increase of boiler power for freight service, which is shown in the large amount of heating surface. The cylinders are 20x28 in., and the drivers are 63 in. in diameter, the centers being of cast steel. This material is also used for the foot-plate and the driving boxes. The boiler front and front door, cylinder head casings, dome cap and dome casings are of pressed steel. The flanging of all of the boiler plates was done upon a hydraulic flanging press, which includes the flanging of the back head. The arrangement of the cab fittings has been given a great deal of attention, with the result that the attachments are conveniently disposed to the advantage of the enginemen. The boiler is of the radial stayed extended wagon-top type, and the dome is placed at the forward end of the enlarged portion. The large diameter of the back head brings the top of the boiler so high above the track as to necessitate making the dome unusually low. A separate dome is used for the safety valves. The piston rods are seen to be extended, which practice seems to be growing in favor with cylinders of large diameter on simple as well as compound locomotives. The driving wheel centers were cast by the American Steel Casting Company, and the axles were furnished by the Midvale Steel Works. The rods and pins are of Krupp crucible cast steel.

The engines are equipped with Westinghouse-American brake on all drivers and with the Westinghouse brake for the tender and train. The safety valves are the consolidated pattern of the 3 in. size, one of them being muffled and the other encased. The boiler is covered with magnesia sectional covering. The connection between the engine and tender is made by means of a spring buffer. The tender has a water scoop and is equipped with the Kewanee brake beam. The design is by Mr. John Henney, Jr., superintendent of motive power of the N. Y., N. H. & H. R. R. Other details taken from the specifications are given in the following table:

Fuel	bituminous coal
Weight in working order	144,200 lbs
Weight on drivers	124,400 lbs
Wheel base, driving	15 ft. 2 in
Wheel base, rigid	15 ft. 2 in
Wheel base, total	23 ft. 3 in
Diameter of cylinders	20 in
Stroke of piston	28 in
Horizontal thickness of piston (piston material, cast steel)	6 in
Dia. of piston rod (piston rod material, Taylor iron,)	3¼ in
Kind of piston packing	cast iron
Kind of piston rod packing	Jerome metallic
Size of steam ports	20 x 1⅜ in
Size of exhaust ports	20 x 3 in
Size of bridges ports	1¼ in
Kind of slide valves	Richardson balanced
Greatest travel of slide valves	6 in
Outside lap of slide valves	1 in
Inside lap of slide valves	line and line
Lead of valves in full gear	1-16 in
Kind of valve stem packing	Jerome metallic
Diameter of driving wheels outside of tire	63 in
Material of driving wheel centers	cast steel
Tire held by	shrinkage
Driving box material	cast steel
Diameter and length of driving journals (axles, Midvale steel)	9 in. dia. x 12 in
Diameter and length of main crank pin journals (rods and pins, Krupp crucible steel)	6 in. dia. x 6 in
Diameter and length of side rod crank pin journals (main pin 6½ in dia. x 5¼ in., front and back, 5 in. dia. x	3¾ in
Engine truck, kind	2 wheel, swing bolster
Engine truck, journals	6 in. dia. x 12 in
Diameter of engine truck wheels	33 in
Kind of engine truck wheels	Paige steel tired spoke
Style	Extended wagon top
Outside diameter of first ring	62¾ in
Working pressure	190 lbs



MOGUL FREIGHT LOCOMOTIVE—NEW YORK, NEW HAVEN & HARTFORD RAILROAD—SCHENECTADY LOCOMOTIVE WORKS.

Thickness of plates in barrel and outside of fire-box, top and sides	5/16 in., dome 9-16 in., tube ½ in., bal. 11-16 in
Fire-box, length	108⅛ in
Fire-box, width	40¼ in
Fire-box, depth	front, 68½ in., back 65½ in
" plates, thickness, sides	⅜ in. back, ⅜ in. crown, ⅜ in. tube sheet, ½ in
" water space,	front, 4 in., sides, 3½ in., back, 3½ in
" crown staying	radial stays 1 in. diameter
" stay-bolts	Taylor iron 1 in. diameter
Tubes, material	Syracuse charcoal iron, No. 11 W G
" number of	312
" diameter	2 in
" length over tube sheets	12 ft
Fre-brick	supported on studs
Heating surface, tubes	1946.72 sq ft
" " water tubes	——— sq ft
" " fire-box	164.38 sq ft
" " total	2111.10 sq ft
Grate surface	30-22 sq ft
Ash pan	hopper with dump plates
Exhaust pipes	single
Exhaust nozzles	4⅞ in., 5¼ in., 5½ in. diam
Smoke stack, inside diameter	near bottom 16 in
Smoke stack, top above rail	13 ft., 9⅛ in
Boiler supplied by	two Metropolitan "Model E" injectors No. 10

TENDER.

Weight, empty	43,000 lbs
Wheels, number of	eight; kind, Paige steel tired plate center
Wheels, diameter	33 in
Journals, diameter and length	4¼ in. diameter by 8 in
Wheel base	17 ft
Tender frame	wood, railroad companys' style
Tender trucks	four wheel, square wrought iron frames, railroad company's style
Water capacity	4,500 U. S. gals
Coal capacity	8½ (2000 lb.) tons
Total wheel base of engine and tender	51 ft. 8 in
" Length, " " "	61 ft 3¼ in

THE RAYMOND IMPROVED GAS ENGINE.

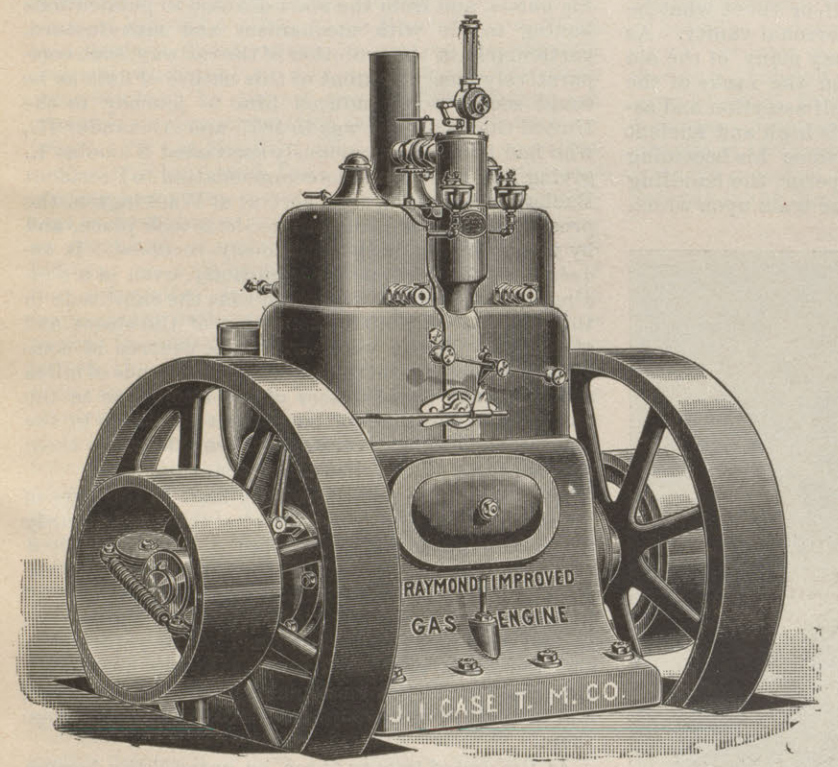
The rapid development of the gas engine and the increasing demand for this form of prime mover for small powers, both for independent motors in large establishments, and for individual plants attests the advantages which it offers in a practical way which cannot be controverted. The gas engine has been in use for a number of years and long ago showed its value. It required development and improvement in the mechanical details of design, with particular reference to the ability to govern the speed satisfactorily. It has now reached a stage which renders it an ideal power producer for many classes of work and it is to-day being received and adopted by engineers who a very few years ago did not give it sufficient attention to discover whether it was a good thing or not. As the demand for this class of machine has increased, some of the old well established manufacturers have taken it up and among them we find the well known J. I. Case Threshing Machine Co., of Racine, Wis. This company has taken up the Raymond gas engine, and is turning out a machine which presents a remarkably fine appearance and which has many good points.

The engines are built in three styles, having one, two and four cylinders respectively, the same principles and details of construction prevailing in all.

The illustrations herewith show the two-cylinder type, Fig. 1 being an elevation and Fig. 2 a sectional view. The base of the engine is in box form and is filled with lubricating oil to a hight which will allow the crank to dip into it about one inch on the downward stroke. This keeps the oil in motion and distributes it over the cranks, bearings, piston, etc., and insures a thorough lubrication of these parts. The cylinders are bolted on top of the base, and above them come the cylinder heads, which form the combustion chambers and carry the valves and valve gear. The valves are of the rotary type and are held to their seats by spiral springs. They rotate on steel ball bearings and are driven by bevel gearing on the crank shaft. Each piston receives an impulse every other revolution and the force of the impulse is regulated by the governor which through piston valves varies the amount of gas mixture admitted to the cylinder with the speed. A slight increase of speed decreases the amount admitted and a decrease of speed increases the amount admitted. From the illustration, Fig. 1, it will be seen that the cylinder pressure holds the valve on its seat, and therefore has a tendency to prevent leakage. The starter, igniter and exhaust ports are also contained in the head and these with the cylinders are covered with a neat casing.

The inlet casing, which contains the piston valve and the lever for regulating its movements, is a single casting and when gasoline or oil is used instead of gas a vaporizer is placed on top of this casing and the governor instead of being connected to the piston valve is attached to a needle valve which regulates the supply of liquid admitted to the vaporizer and in this manner keeps the speed from varying. When this vaporizer is used the immediate supply of liquid is kept in a glass reservoir having a capacity of one-half pint, and this is replenished by a small pump, propelled by a belt from the crank shaft, which keeps this amount constantly on hand and forces any surplus back to the main tank or source of supply which may be established at any convenient point which is free from the danger of fire. The engine can be changed from using gas to gasoline or oil at any time without shutting down by simply turning off one supply and admitting the other.

Electric igniters only are used upon all sizes of the engines for both gas and oil, and either a storage or a primary electric battery is furnished with each engine for supplying the necessary electricity. The electrodes wipe each other at each explosion thus preventing them from being corroded with non-conducting substance produced by the gases. It is stated that these ignites will run for months without the slightest attention. The starter of this engine is one of its new features and is somewhat of a novelty in gas engines as it does not require the customary preliminary operation of turning the engine over by hand and it also does away with any danger of starting the engine in the wrong direction. The one cylinder engine is made in 10 sizes ranging from 1 to 20 horse power, the two cylinder type in 10 sizes ranging from 4 to 50 horse power, and the four cylinder in 65, 85 and 100 horse power sizes. The two and four cylinder engines are said to be particularly well adapted for running electric lighting plants and dynamos for any class of service owing to the perfect regulation and low cost of operation. They are guaranteed to run on 15 cubic feet of natural gas per horse power per hour and records have been taken where only 12 ft. were consumed. The oil engines are guaranteed to run on $\frac{1}{10}$ of a gallon of 74 deg. gasoline per horse power per hour and engines in actual service are said to be running on two-thirds of that amount.



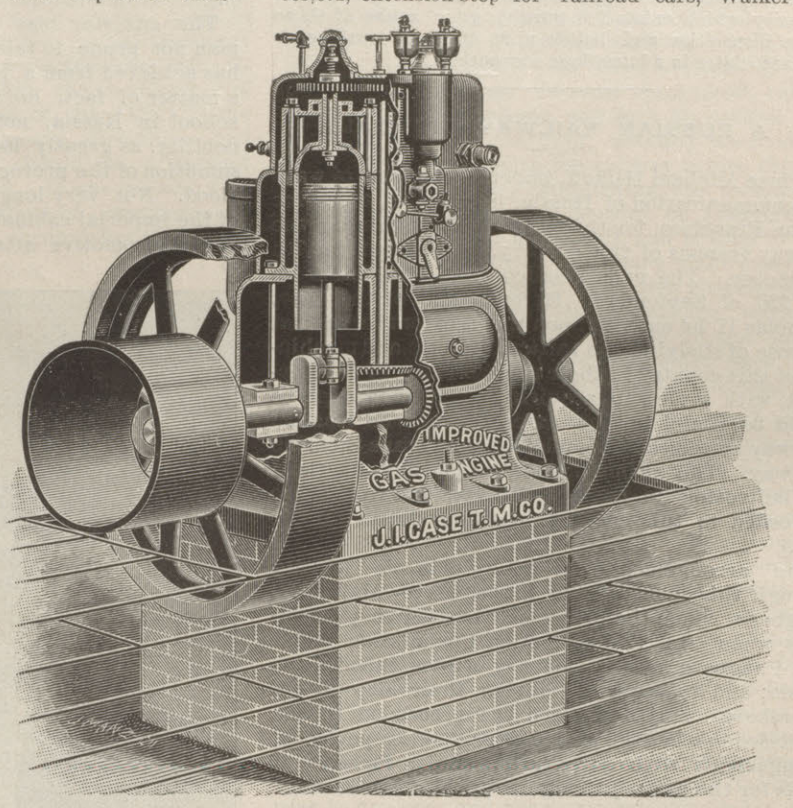


FIG. 1.—ELEVATION.—THE RAYMOND GAS ENGINE.—FIG. 2.—SECTION.

OUR PATENT RECORD.

(Our record of patents that most interest our readers is compiled regularly by our Washington correspondent with the idea of being a complete index. Space forbids more than the citing of a reference, but the complete specification or drawing of any patent desired will be mailed to any address upon receipt of 10 cents in stamps, and other information in regard to patents will be cheerfully given. Address all communications to our correspondent, Edw. C. Weaver. Attorney and Counselor, McGill Building, Washington, D. C.)

568,355, rail joint, Ferdinand Krusinski, Rockdale, Tex., filed June 22, 1896. Serial No. 596,443 (no model).

568,356, car coupling, Ferdinand Krusinski, Rockdale, Tex., filed June 22, 1896. Serial No. 596,444 (no model).

568,359, metallic railway tie, Wm. H. Larimer, Terre Haute, Ind., assignor of one-half to Mrs. Clinton M. Thompson, same place, filed December 17, 1895. Serial No. 572,450 (no model).

568,371, railway brake, John E. Reyburn, Philadelphia, Pa., filed November 12, 1895. Serial No. 568,668 (no model).

568,378, draw-bar, John S. Stout, Oxford Junction, Ia., filled June 25, 1896. Serial No. 596,928 (no model).

568,385, rail-bond, Frank H. Underwood, Auburndale, and Fred H. Daniels, Worcester, Mass., filed Ap 1896. Serial No. 586,531 (no model).

568,420, interchange coupling attachment, James B. Thomas, St. Louis, Mo., filed Aug. 21, 1895. Serial No. 560,036 (no model).

568,430, annunciator time-caller for railroad trains, John J. Cowhig, Manassas, Va., filed Feb. 25, 1896. Serial No. 580,662 (No. model).

568,446, railroad-tie, George F. Key, Ann Arbor, Mich., assignor of two-thirds to Frederick W. Hawkins, Detroit, Mich , and F. Bernard Hawkins, Hammond, Ind., filed Dec. 16, 1895. Serial No. 572,277 (no model).

568,476, journal-box, William Falkner, Connellsville, Pa., assignor of one-half to Joseph McMahon, same place, filled June 30, 1894. Serial No. 516,150 (no model).

568,528, lubricating car-wheel, Eugene Ewers, Ardmore, Mo., filed May 14, 1896. Serial No. 591,562 (no model).

568,601, extension-step for railroad cars, Walker Y. Carlton, Centralia, Va., filed Jan. 14, 1896. Serial No. 575,427 (no model).

568,619, railway tie and clamp, Peter Keshner and Henry Laux, Carlyle, Ill., filed May 15, 1896. Serial No. 591,612 (no model).

568,699, rail-joint, John L. Pope, Cleveland, O., filed Jan. 8, 1896. Serial No. 574,682 (no model).

A CAUTION AGAINST CARELESSNESS.

To guard against accidents due to carelessness and misjudgement of railway employes it is frequently necessary to call the attention of the men to the possibilities of accident which continually surround those who have to do with the handling of trains. It is not often if ever that employes wilfully disregard rules but for the purpose of keeping them in mind of their responsibilities, a circular like one recently addressed to the enginemen and conductors on the Illinois Central Railroad by Mr. A. W. Sullivan, general superintendent of that road, should have the desired result. The substance of this circular is as follows:

A long period of exemption from serious accidents upon the road has led to a feeling of security unwarranted by the conditions which surround your daily work. While the company has made heavy expenditures to improve the physical condition of the property and has provided ample means and facilities for safe operation, there still remains the same necessity that has always existed for faithful co-operation on your part, to secure immunity from the perils which inevitably follow careless performance of duty.

There is no portion of work that requires less exercise of judgment than the proper handling of train orders, for the reason that the rules relating thereto are explicit to a degree that leaves nothing to be done on your part but to read them carefully, understand them thoroughly, and carry them out rigidly. It rarely occurs that orders clearly understood fail of their purpose. In most instances, the trouble has its origin in a lack of understanding, through non observance of the rules. The rules require that, after an order is made complete, it shall be read aloud by the conductor to the operator; it shall then be delivered personally by the conductor to the engineman, and not only read aloud by the engineman, but understood, before the train is started. As a further safeguard, the engineman

is required to show his orders to the fireman, and the conductor to the baggageman or flagman.

The vital necessity for an observance of these simple requirements can be appreciated when it is know that in nearly every instance where such collisions have occurred and in many others where fortunately trains have not come toge estigation has revealed an indifference to the observance of the rules in reading and understanding orders, following which the subsequent negligence of forgetting them was a natural result.

The duty of the management is complete when it provides rules of operation which adequately meet the requirements of the service, and, by proper examination, allows, so far as its supervision can go, no unqualified person to assume charge of its engines or trains.

The observance of the rules must, from the nature of the service, rest largely upon your honor and sense of duty, and this appeal is made to awaken in you a realizing sense of the responsibilities appertaining to your work, and the necessity which exists for purging your ranks of those whose disposition and habits unfit them to continue as your associates in a hazardous occupation.

A RUSSIAN RAILWAY OFFICIAL.

Prince Michael Hilkoff, imperial minister of ways and communication of Russia, is expected to arrive in San Francisco, for the purpose of examining the railway systems of this country, on or about the 7th of October. The prince sailed from Yokohama on the 22d of September. By command of the Czar, Nicholas II, he entered upon this trip for the especial purpose of studying the railway systems and machinery of this country in their present state of development, with a view to acquiring such knowledge as would be useful in the extension of the Russian Railway system and completing the Trans-Siberian Railway. The prince made the journey overland to Vladivostok in Eastern Siberia, and from there proceeded to this country, visiting Japan on the way.

The arrangements for the prince's journey through this country were intrusted to Maj. J. G. Pangborn, whom the prince had treated very hospitably when the Transportation Commission under Maj. Pangborn, made a journey across Siberia and Russia; and subsequently during their stay in St. Petersburg. Maj. Pangborn has proceeded to San Francisco to meet the prince after having perfected arrangements with railway companies for special trains for the entire journey across the continent.

As already noted in these columns, the prince will stop at Denver, Kansas City, St. Louis, Chicago, Detroit, Cincinnati, Pittsburgh, Altoona. It is possible that he may visit Washington, and after visiting Philadelphia and New York, he will take a trip over the New York Central road to Buffalo and Niagara Falls. He will sail from New York early in November to join the Czar and return with him to St. Petersburg. The exact dates of the visit of Prince Hilkoff to the various cities named are, of course, dependent upon the date of his arrival in San Francisco. It is believed, however, that his visit to Chicago, will be about the 13th and 14th of October. Regarding these dates and the arrangements made for the entertainment of the prince, we will duly advise our readers. Meantime a sketch of the life and character of one of the most remarkable men of the day, will be found exceedingly interesting. The portrait of Prince Hilkoff which we publish is from a very recent photograph and gives an excellent idea of the man. The portrait of the Czar of Russia is also from a recent photograph which has not been generally published.

The Czar, Nicholas II, may be said to be somewhat of a railroad man, as he is and has been from its beginning, president of the Siberian Railway committee. To this position he was appointed by his late father, Alexander III, while he was yet Czarowitz. Determining to be something more than a mere royal figure head of the enterprise, the Czarowitz proceeded by way of Europe, Africa and Asia, principally by water, to Vladivostok, which was to be the eastern terminus of the Trans-Siberian Railway. There he overturned the first spade of soil and inaugurated the work of construction at the eastern end. Subsequently he made exceedingly arduous journeys across Siberia and Russia to St. Petersburg; traversing upward of 5,000 miles, drawn by animal power, in the spring of the year, when the journey was an exceedingly difficult one. He examined personally the whole route of the road, and gained a valuable knowledge of this very important portion of his domain.

Prince Michael Hilkoff, has a most interesting personality. A Tartar born and bred, tracing direct descent from a princely origin antedating the Romanoffs, of which his Imperial master is to-day the august head, the present Hilkoff, with six centuries of recorded ancestry behind him, has never throughout his eventful life found more pleasure or profit, from his way of thinking, than in the comprehension, quoting him literally, "I am a good bit of a Yankee myself." This was his greeting to the members of the World's Transportation Commission of the Field Columbian Museum, when meeting them at Krasnoyarsk, in Western Siberia, after their four thousand mile sledge ride through from the Japan Sea. To prove he is "a good bit of a Yankee" himself, and appreciated how the thing would be done in Yankeeland, the special train upon which the members of the commission, as the guests of the prince, journeyed from Krasnoyarsk to St. Petersburg, crossed no less than six of the largest rivers in Western Siberia upon rail laid over their frozen surface, and to reach which, from the high banks, necessitated in several instances the overcoming of engineering difficulties of no ordinary nature.

The minister may be correctly regarded as a man not prone to talk of himself, or vaunt what he has achieved from a feeling of personal vanity. As a matter of fact, he is viewed my many of the old school in Russia, notably within the ranks of the nobility, as greatly lacking in self-assertion and assumption of the prerogatives of his high and ancient blood. Not very long ago, and since his becoming of the imperial cabinet of the emperor, the handling of the locomotive attached to the train upon which

PRINCE MICHAEL HILKOFF.

he was riding not being to his liking and convinced that the failure to keep to the schedule was the fault of the engineer and not of the engine,—which by the way was an American Baldwin,—he mounted the foot-board and removing his tall hat and uniform coat, ran the train himself the succeeding hour or more, making up the lost time and taking it into the terminal station on the minute. Such manner of dignitaries "get there," if the slangy but significant phrase will be tolerated, not through self praise or exceeding volubility; rather by the force of an individuality positively practical and physical.

When hardly out of short clothes and, as common with sons of the nobility, he became one of the pages of the empress. At sixteen he was an officer in the guards of Her Imperial Majesty, and he so remained during the Crimean War. Meantime his inclination ran to the practical and mechanical, not to the professional; even though the latter, offered in the soldier's life, opened up to him, with such influential family associations as were his, a future well calculated to inflame the fancy of a stripling. He found himself far more interested in the discussion of the problem of transport his government had to face in the prosecution of the war, than in the military tactics demanded in the enforcement of defense and assault. Young as he was, the deplorable insufficiency of the means his countrymen had at hand to communicate with, supply, and reinforce the army in the Crimea, made a deep impression upon him. He had seen but little of the actual development of the railway, although Russia had a small line before the end of the "thirties"—the Tsarkoe-Selo, about fifteen miles in length, had completed the Warsaw-Vienna line from Warsaw to the frontier in 1848, and opened the direct line from St. Petersburg to Moscow—the famous pencil-and-ruler route of the first Nicholas—in 1851. The year following governmental construction had begun on the line connecting St. Petersburg with Warsaw to thus open the way to an all-rail communication with the outer world. A couple of years later, and the war cloud, which had so long threatened, burst, and England, France and Russia became involved in the Crimea to such an extent that in all pertaining to material internal development, the Russian Empire practically stood still for the succeeding three or four years. Possibly no Russian of his age at the time so grasped the situation and so recognized the disadvantage experienced from the absence of facilities for the mobilising of the troops and for the conveyance of war material as he.

Almost from infancy the prince evinced to a marked degree the well-known trait of the Russian to command other languages with a fluency equal to that for his own, and before he was out of the guards he read, wrote, and spoke English, French, German, Spanish, and Italian as if each were the mother tongue. Enabled to peruse any print coming into his hands, and from the start devoted to publications having to do with mechanism and manufacture, particularly in the evolution of the railway, such comparatively meagre extent of this nature of data as he could secure soon induced him to journey to the United States. This was in 1857, and Alexander II., who had two years previously succeeded Nicholas I., giving him most gracious commendation to President Buchanan, to whom, upon arrival at Washington, the presentation by the Russian minister took place, and by whom he was very courteously received. It required no extraordinary perspicacity, even in a budding man of twenty, to discern that the similitude in the relatively primitive condition of the states and of Russia. To the westward of the centres of commerce and activity of the republic, thousands of miles away, lay the broad waters of the Pacific, as to the eastward of the seats of goverment and trade in the empire, thousands of versts intervened between them and the same almost boundless sea.

Very few of the nobility of any land in the days of '57 saw the hundredth part of what this hardy, sturdy and indefatigable young Russian did of the United States. When he turned his face homeward impressions had been so indelibly stamped as to become of his very nature, and the "good bit of a Yankee" is no less such now than when in 1858 he returned to the European continent imbued to the heart with American ideas. A subsequent year spent in travel and investigation throughout Europe did not change them.

At the age of twenty-three he entered the foreign office in St. Petersburg, and three years in the ministry of foreign affairs in no wise lessened his purpose to finally enter railroad life, and in reality enabled him, through the time afforded, to ponder over the possibilities, to reach the conviction that to succeed he must understand, as his American experience had led him to phrase it, "from the ground up."

To none did the revolution in the order of things resulting from the emancipation ukase of Alexander II. come with more crushing force than to the elder prince, the head of the house of Hilkoff. Proud in the extreme, haughty to a degree almost reaching intolerance, he was, as the present prince somewhat quaintly remarked, "a man always on horseback," that is to say, felt the blood of centuries in him upon all occasions, and brooked naught in any shape or form from an inferior. With his habits of life, his training and his beliefs, he was ill-prepared for the crisis which came upon him, and while loyal to his emperor, was still embittered by the condition in which he found himself. On the other hand, his son Michael hailed the freeing of the serfs as his own deliverance. Independence of action and freedom in the choice of his avocation was to him the open sesame to a future of his own making. Caring nothing for money for mere money's sake, the loss of fortune in the presence of health and vigor counted as simply an incident and a not over important one. Decidedly democratic in his view of the situation, and with nothing of his father's intense absolutism, the young prince could see and feel the rights of the former serf, as like himself, human, to sympathy and assistance in shaping himself to his changed condition. He had not agreed with his father in thus viewing the duty before him, and the pivotal point of their relations towards each other was reached when the son accepted from the emperor the appointment of judge-arbitrator, thus placing him in the position of defending alike the serf and the noble from infringement upon such rights as each might have in arriving at a basis of operation which would insure the one labor, and through it sustenance, the other the cultivation of estates and from them an income.

To such a pass did things ultimately come that the younger had a plain talk with the elder in which the latter was asked to leave all he had to another son, as he, the former, would under no circumstances ever accept from him a rouble's value; that whatever

he was to have would be of his own creation, and he had no fear in thenceforth depending wholly upon himself. Naturally America was the prince's first thought. So for America he set sail, and not long thereafter a young fellow presented himself before Quaker Wainwright, a Philadelphia machinist and railway contractor, and respectfully requested that he be given a job. In response to the inquiry as to the kind of a job he wanted, the prince said he did not exactly know, as he was not aware just what he could do, but he was willing to attempt anything which might be assigned him and so find out. Could he make bolt-heads? Well, he didn't know, but would try. And upon bolt-heads began the descendant of Tartars traceable direct from the year 1200, and did so well that he commanded a dollar a day from the beginning. Meanwhile he was Magill—John Magill. When first asked his name he hesitated, apprehensive if he announced himself a prince and a Russian he would be at a serious disadvantage in playing the role of a common workman; so getting as far as his given name Michael, he stopped, and Mr. Wainwright, not grasping the pronounciation correctly forthwith rejoined: "What Magill?" The prince in desperation replied "John," and thus he remained for the succeeding four years or more. Demonstrating a handiness at anything allotted to him, and ever evincing an alert and cheerful willingness to persevere, his industry as well as his intelligence, speedily made him a favorite. It has been said in some of the fragmentary notices which have appeared from time to time in years past that he was employed for a period in the Baldwin Locomotive shops in Philadelphia, and likewise in the Pennsylvania Railway shops at Altoona. These are errors, for, as a matter of fact, his first actual connection with labor pertaining to the railway, and his first practical knowledge of a locomotive, were both resultant from his going, still in Mr. Wainwright's service, to the Argentine Republic, where the Philadelphian, in conjunction with others, had taken a contract for the construction of a railway from the Platte river over the mountains to the west coast.

The prince from the position of an ordinary hand in the blacksmith shop advanced by degrees to sub-foreman and then to foreman, and finally to the supervision and direction of the locomotive roundhouse. The general manager was the first engineer or locomotive driver to whom the prince played stoker. The places named were in both instances filled most unexpectedly, the manager proving himself the man for an emergency by pulling off his coat and jumping aboard the engine, calling upon the prince to follow him, the two taking a train out of the station when striking engineers and firemen had refused to do so. The manager held the throttle and the prince shovelled the coal, and the train having been thus manned for three or four days, the former insisted the latter should run the machine himself, and continue to until the trouble with the men could be adjusted. It mattered not that the prince disclaimed all technical knowledge of engine running, declaring he had never manipulated one and questioned his ability to handle it with safety; become the engineer of that train he had to and he did, much to his subsequent satisfaction, for nothing has stood him in better stead the long years since than his thoroughly practical knowledge of a locomotive.

The elder prince while abating little, if any, from the traditions of his ancient line as to the abasement of one of the blood in toiling with hand and brain, nevertheless could not other than admire the pluck and respect the pertinacity of the son who for nearly five years had so stoutly and steadfastly maintained his purpose to live wholly upon the means commanded through his own individual efforts, and while the old prince could not agree with his boy he nevertheless yearned to see him. Thus it transpired the prince bade good-by to South America, sailing from Buenos Ayres for England, direct. He tarried for a period in the latter named country to add some finishing touches to his practical knowledge of locomotive construction, spending several months in the erecting shop of a well known company at Birkenhead. Proceeding to Russia, he with habitual celerity at once sought employment. Naturally with the thorough practical experience he had he expected a position of some authority and wherein his information could be put to general rather than individual use. He was therefore, chagrined and, as he honestly confesses, deeply hurt in his pride, by being offered nothing above the position of locomotive driver or engineer. "It did not seem just the thing" said the prince when speaking of the occurrence, "after all I had gone through with to learn what I knew, serving in every capacity from boiler-maker, pipe-fitter, blacksmith, foreman of shop, stoker, driver, and so on to locomotive superintendent, that I should come back to my home and be regarded as only competent to drive an engine on an accommodation train. But as I had, and will ever make it the rule of my life to do what I have to do, to the best of my ability, I accepted the engine, ran it for three months, when I was created locomotive superintendent, and remained such for five years." He was away from the old centers of his country, those to which his early associations had endeared him. His children were growing up, and for them he wanted the advantages of education, then scarcely obtainable elsewhere than in Moscow or St. Petersburg. Fortune favored him, an opportunity offering on the Moscow line, where he served as locomotive and carriage superintendent until the end of the "seventies," the beginning of the "eighties" opening up to him a field of operation and the securing of an experience he had long wished for.

Russian military movements into central Asia, in their dependence upon camel trains for the transport of supplies, had encountered such difficulties and suffered reverses so serious, that the brilliant and dashing Skobeleff, in command of the Akhal Tekke expedition of 1880, with his usual directness and boldness, determined there should be a radical change in the transit situation. It was he who first put into practical form the project of constructing a railway in the Trans-Caspian, recognizing that other

CZAR OF ALL THE RUSSIAS.

means than the existing must be at his command for the conveyance of stores and supplies generally, as well as of troops in an emergency. Upon his suggestion, General Annenkoff, imperial director of military transports of the empire, was ordered to central Asia to devise and assist in the perfection of the plan of construction, and of the latter he assumed control to a purpose which subsequently rendered him the most famous military railway man of his time.

Almost the first act of General Annenkoff upon assuming command of the railway movement in central Asia was to secure Prince Hilkoff's pledge to join his staff as chief of the mechanical division of the work. This appointment was confirmed and when, some months later, General Annenkoff had to leave the Trans-Caspian, Prince Hilkoff succeeded to the full charge of everything having to do with the railway and its construction. The following year Prince Hilkoff was formally designated chief director, and forthwith manifested the exceedingly practical and thoroughgoing view of things which has always distinguished the administration of whatever over which his authority has been made unquestioned.

At this juncture, an old friend and associate, hav- by appointment of Alexander III. assumed the Russian official representation in Bulgaria, induced Prince Hilkoff to assent to becoming the minister of public works in that country, drawing up, as such, the project for the Sistovo-Sofia-Kunstendil Railway, while at the same time controling all railway matters there.

Meantime matters as related to the railway in the Trans-Caspian were in most unfortunate shape. The official who had succeeded Prince Hilkoff was constantly at sword's-point with General Annenkoff, the latter declaring ruinous the conduct of the line subsequent to the prince's departure, the two finally bringing about a commission from which the general came away with flying colors, the other party going to the wall. Then came an imperial edict which would have made even Tom Scott raise his eyebrows, nothing less than to extend the operations which had been planned upon the basis of the building of 130 miles in two years to the construction and completion of 500 miles within the period of one year. Five hundred miles of a 5 ft. gage in twelve months, with everything, to the ties, spikes, fastenings, rails, bridge material, and even tools to be shipped from European Russia, and thousands of versts of the transit by rivers frozen or with water so low as not to be navigable for barely half the year was a pretty large sized order, as any American railway man, whatever may have been his experience, will admit. The imperial rescript or order was of June 1, 1885, and of necessity some months had to be devoted to getting ready for so unexampled—all things taken into consideration—a feat of railway construction. General Annenkoff, relieved of the prince's successor, and with the prince himself back as chief coadjutor, actually succeeded in reaching the Oxus with the railway before the close of the following year, establishing the terminus at and opening the line to Chardjui on December 14, 1886. Another year and a half, and in time to be coincident with the fifth anniversary of the coronation of Alexander III., May 27, 1888, the concluding 250 miles—in round figures—to Samarkand were completed, and on that day the whistle of the locomotive and the rumble of the railway train were heard in the ancient city of the mighty Asiatic conqueror.

After upwards of eight years' service, all told, in central Asia and the Trans-Caspian, the whole period occupying the most responsible position, five and a half years in general charge, and the final two years in sole authority, the prince officiated as director of several lines in European Russia. Something over three years ago he was made general inspector of the government railways, which carried with it a general supervision of all lines. A year and a half ago he was raised to the highest post in connection with the railways and transport generally in the empire, becoming of the official family of his beloved Czar, as minister of ways of communication. As such he still maintains close identification with the railway in central Asia; the extension from Samarkand to Tashkent, the official capital of Turkestan, now in progress and nearing completion, being under his care and direction. The prince has also been intimately identified with the Trans-Siberian, the greatest of all railway enterprises of the old world, almost, if not quite, since its conception. He was for some time the director of the railway which reaches to the boundary line between European and Asiatic Russia, and before that, as chief inspector, he had much to do with matters in connection with the progress of the Siberian construction. He had hardly become at home in his ministerial headquarters in St. Petersburg before he determined to see for himself the nature of country the railway was traversing, and through his own observation learn of the great Baikal lake and the difficulties his engineers were encountering in their plans concerning it. Despite all that was said to him of the arduous and trying nature of the journey he contemplated, which was the pushing through from end of track by post-horses upwards of two thousand versts to the lake, he persisted and accomplished the journey. His last thousand versts—six hundred miles—between Krasnoyarsk and Irkutsk he covered with horses in three and a half days, averaging fourteen hours per day en route. On the return trip he cut the resting time an hour a day and accomplished the distance in three days.

The Czar of all the Russias by whose command Prince Hilkoff comes again to "see and feel America" as he expresses it, is to-day undoubtedly the most thoroughly and personally interested railway man among the crowned heads of the world. While Czarowitz he never failed in attendance at a stated meeting or in participation as the presiding officer of the Siberian Railway Committee. Since he became Czar his interest has, if anything, increased instead of decreased. Of his primary announcements upon succession to the crown of all the Russias, was that he would not relinquish the presidency of the railway, and, as invariably as he was present at every meeting prior to his elevation, so has he been since, and of all things over which his sway extends, nothing exceeds in genuine interest to him, or in which he has a larger conception of developing importance than the Siberian Railway.

The despatching of a minister upon the mission which is Prince Hilkoff's in this instance is unprecedented in Russian annals, and to the United States it is of an importance which the immediate future will demonstrate.

THE RAILWAY REVIEW

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THE Atchison, Topeka & Santa Fe road is setting an example which other roads might well follow. It has abandoned the operation of its coal properties, leasing its mines to operators and buying its coal the same as any other consumer. The officers of the road are evidently impressed with the fact that the business of a railroad is transportation, not merchandising and that they need to be in a position to put all customers upon a common footing. Were this the universal practice such proceedings as have lately been instituted against the official of a coal mining and carrying road in Buffalo, would not be necessary. The revenue account of any railroad should be neither augmented nor diminished by gains or losses from outside business; a proposition which the sooner it is accepted, by all railroads, the better it will be for the entire railway system.

THE iron and steel makers regard recent trade developments and indications in a favorable light for profitable activity during the winter months. These developments are the extraordinary influence of gold by way of payment for purchases, the enormous exportation of foods and cereals to foreign parts which presents the characteristics of permanency, the large crops which are being marketed at fairly remunerative prices, the return to industrial activity in so many localities, and the unmistakable indications afforded by the public as to the attitude of this government on vital questions. It need hardly be expected that there will be a rush to buy goods or materials in any direction. There must, however, be large purchases. This has already set in as indicated by hardening prices in many lines of trade. In the heavier industries there have been a sprinkling of big orders for material, but the captains of industry know the captains of capital must first move, must first indicate their course and this they will do cautiously, and not so much in words as in investments, the first evidences of which will be in the thicker volumes of smoke above our industrial centers. A strong footing has been made within even a month, but in the excitement and fever of the hour it is not noticed. The brakes are on and production is far within safe limits. The oft repeated advice is now more appropriate than ever to see that caution does not carry great consuming interests into advancing prices.

A GOOD illustration of the influence of increased care in the handling of materials and the operations incident to car building and repairing, is seen in the comparison between the past and present cost of maintaining the freight equipment on one of the largest of the western roads. The cost of maintaining thirty-six thousand cars last year was found to be the same as that required for the maintenance of twenty-seven thousand cars ten years ago. Allowing for all differences in cost of material this result shows an admirable improvement. It is not due to the use of better material, because it is getting to be more and more difficult to obtain satisfactory lumber for car work, and it is fair to say that the quality of this material has not improved but deteriorated in this period. This is taken to be the result of a large number of improvements whereby material is handled and prepared cheaper than ever before, and any one item of which would probably be considered insignificant in its influence. Improved methods of loading and unloading wheels and handling heavy pieces in the shop contribute to this result, as well as arrangements of the wheel tracks upon inclines which obviate the necessity of rolling them by hand, the arrangement of lumber storage yards with reference to once handling material when required for the shops, the layout of planing mill machinery whereby the large pieces, such as sills, platform timbers, plates, etc., are passed through the mill from one end to the other without raising or lowering them or carrying them an inch by hand, all have a bearing upon this result, which should be encouraging to those who are engaged in promoting still further improvements in these operations.

IT HAS been common practice to put drop grates in locomotive fire boxes and to locate them at the front end of the fixed grate. The object of this location is to interpose a solid obstruction to the passage of the air which would otherwise go through the front end of the grate and prevent it from cooling the gases which go to the tubes from that end of the grate. The question is now being raised as to whether this object is attained by this means as well as has been supposed. An experiment has recently been tried which seems to show that perhaps the expected protection is not afforded and that the desired result may be better attained by placing the drop grate at the rear under the fire door. The advantage expected from doing this is to provide a means for shaking the fire at the front end and keeping the fire alive at the front corners down to the top of the grate, allowing the coal to coke under the door instead of at the front end. The superintendent of motive power who is trying this experiment believes that while coal rests on a drop grate at the front end the air gradually works its way up through the coal from the rear, forming holes which admit an excess of cold air directly to the tubes and cools them. He believes that these holes are not closed by shaking the grates. It will be rather interesting to see how this experiment results and as the practice of years' standing on a large road will be changed if the results are as expected the matter possesses more than passing interest. The excess of air in fire-boxes is the source of much waste and ability to control the inlet of air is very important. It is questionable whether enough attention is being paid to the regulation of air supply and to its admission in such a way as to insure its becoming mixed with the gases. While such experiments as the one referred to are not entirely new the subject seems likely to receive thorough investigation in this case.

IT IS generally admitted that the power and what may be termed the endurance of locomotives upon the road are limited by the ability of the boiler to make steam fast enough to supply the demand. The greatest improvements which are looked for in the operation of locomotives are in the direction of better use of fuel, and it is along this line that the efforts of many experimenters are being made, looking to the production of such designs as will give more power at less cost. If the troubles of engineers in another field can give comfort to these men consolation may be had from the fact that marine designers are working in very much the same direction, and what is more the success which they are attaining should give considerable encouragement. Mr. A. F. McGinnis, president of the Liverpool Engineering Society, is the author of a statement to the effect that whereas in marine practice in 1840 a displacement of 0.578 tons was propelled eight knots by one ton of coal, in 1885 one ton of coal propelled 3.4 tons displacement 8½ knots. There was also an improvement in the proportion of live to dead load, which is analogous to that which is sought for in the design of freight cars, in that the proportion of earning weight has been raised from ten per cent of the total displacement in 1840 to sixty per cent in 1885. There must have been a great improvement since the latter date, but more recent figures are not given. Accompanying this improvement in efficiency there has been another which is of almost equal interest, though perhaps not reflecting so much scientific as executive ability. This is in the great reduction in the time required to make the voyage across the ocean. A number of the famous fast liners have been beating their records, and it may be said that every few weeks a new record is established for these vessels. The most interesting point about these fast runs is that they are not confined to the newer ships, but that the older vessels are beating the records which they established for themselves, in some cases years ago. This is a worthy object, because the rapidity of voyages increases the earning capacity of a ship. If carried too far danger is incurred, but up to this limit an increase of speed is clearly desirable. It is reported that the old liner Brittanic of the White Star Line, has recently improved upon her best record made some fifteen years ago. The reason for these improvements is that greater interest is being shown in their work by the engineers who are in charge of the machinery at sea. It is not so common as formerly, to see the chief engineers of large vessels enjoying themselves upon the decks, because they are giving closer attention to the fires and to the manipulations of their firemen. It is also interesting to know that upon the liner St. Paul an arrangement has recently been made to give premiums to the firemen for efficiency. Many have serious doubts of the advisability of offering premiums to men for good work, but the advantages to be derived from a more careful use of fuel are too apparent to admit of argument whether upon sea or land.

FOREIGN EXAMPLES IN SIGNALING.

A record of a train mileage of 7,719,618 handled on lines aggregating 2,531 miles in length, operated for a year without any passenger train accident is a good one which speaks well for the carefulness of the officers who are responsible for the transportation. The report of the commissioners of the railways of the New South Wales government, a portion of which was referred to last week, presents this excellent record and a partial explanation of the immunity from disaster is found in the table showing the condition of the railways with regard to interlocking appliances. The amount of track which is operated under absolute block signals is nearly one-half of the total length of the lines. This fact explains the safety of operation and closely allied to absolute blocking is the general use of interlocking apparatus. The returns show that of a total of 519 places where interlocking appliances are applicable over 63 per cent have been equipped with the devices and authority has been given for the interlocking of a number of other stations and sidings. Of the total length of the government lines 1,150 miles are operated on the absolute block system 1,014 miles being operated by absolute staff or tablet systems and 1,329 miles by permissive staff systems. The electric train staff apparatus has only lately been introduced but it is considered as entirely satisfactory on the busiest sections. The "Quirk" pick up apparatus is used and the staffs are transferred at high speeds. The lines where traffic is light are not neglected and upon these, the electric interlocking staff instruments are installed the transfers to and from the instruments being made by the trainmen at the staff stations without the employment of additional operators. The rules for the operation of the staff and tablet systems on the the New South Wales Railways are very explicit and they are carefully adhered to in the handling of trains. The operation of single track lines is nowhere more safely carried out than there and the methods used are worthy of imitation.

The staff system is engaging more attention in this country and the recent improvements which have been made in connection with its operation, which are outlined in the abstract of a paper by Mr. Charles Hansel, published last week, shows that it is being adopted to meet the conditions existing in this country in a way which seems to be removing the objections which have been urged against it by some who have considered the transferring of staffs as a

troublesome and uncertain operation. The modification of the apparatus which renders it possible to secure all of the safety provided by the train staff system by the transfer of small rings weighing only two and one-quarter ounces between the operator and the enginemen and conductors of trains, constitutes one of the greatest improvements which have been made in the system, and this method added to the additional safe guards in the form of electrically controlled semaphore signals at the block stations will go far toward making this system popular. The train staff system needed special modification for adaptation to the conditions of our transportation methods. It is worthy of the attention which has been given it by those who are interested in its introduction and it has been brought into a condition which more than ever warrants railway officers in investigating and experimenting with it on busy pieces of single track.

Referring again to the example which foreign railways are setting with regard to absolute blocking, it is interesting to see by a recent report of the Board of Trade of Great Britain that with a total of 11,252 miles of double track and 8,774 miles of single track in the United Kingdom, 11,235 miles of double track and 7,692 miles of single track are worked under some form of absolute block system. Of the single track, 2,903 miles are worked by train staff. Fifty-three miles are worked without the train staff and 4,736 miles are worked on the electrical train staff or tablet system. Only 2.59 miles of double track are worked on the permissive system. There are 773 miles of single track, on which only one locomotive under steam or two or more locomotives coupled together are used, which is probably on account of the absence of block systems. There is little doubt that the employment of block systems will be greatly extended in this country, but some time will elapse before 98 per cent of the lines are so equipped. With such a proportion, England's example is a powerful argument for the introduction of similar methods here, inasmuch as collisions are rare in Great Britain.

TRAFFIC COMPACTS.

Another change has taken place in the traffic affairs of the western roads, and another experiment in voluntary association for the maintenance of rates is a recorded failure. The Western Freight Association, the latest successor of the old southwestern pool has succumbed to the inevitable, demonstrating anew the futility of endeavoring to maintain an equitable basis of rates in the absence of an enforceible division of revenue. Hoping against hope appears to be the normal condition of railway management and it is astonishing with what degree of assurance railway officials will enter into an agreement which experience should teach is not worth the paper upon which it is written, so far as the exercise of effective restraint is concerned.

It may be seriously questioned if association agreements in their present form and under present conditions do not in some degree contribute to the demoralization of rates. The fact that such a compact exists, together with the knowledge that it is of no legal force, is a temptation to some men to seek an advantage over their competitors; whereas, if no agreement existed and the condition was one of "a fair field and no favor", every line would be careful lest a variation from recognized tariffs should provoke a rate war that would be even more ruinous than those of the past. However this may be, it is certain that if any reasonable basis of earnings is to be maintained, some method more efficient than the recently tried forms of traffic association must be adopted.

Perhaps no better illustration of the lack of respect with which such associations are regarded, by railroad men, can be found than in a recent letter of the commissioner of the Western Freight Association to the officials of the roads comprised in its membership, given below.

To the Traffic Officers of the Associated Roads:

The disorderly manner in which some members (not all) are proceeding in the publication of individual tariffs results in no special advantage to the companies which thus act. The method referred to is, without waiting to advise this office or associate members or competitors, to notify the Interstate Commerce Commission at Washington of the intention to make effective reduced rates. It is not asking much to request members, until better conditions can be inaugurated—which will surely be done before long—simultaneously with your advice to the commission to inform the undersigned of your intentions. Several members have instructed in accordance with the foregoing, and no disadvantage will result from parties doing likewise. We are certain to be ultimately informed, but two days are apt to elapse before the bulletin from the joint agent employed by the Western Trunk Line committee reaches this office. Inasmuch as it is certain then to come to our knowledge, members should have no valid objection to advising us as promptly as they do the tribunal at Washington.

The entire procedure in ignoring established usage to which members have solemnly agreed strictly to conform, is indefensible, and as a special meeting can be compelled monthly, if need be, on request of any party, in order to make effective in a considerate way a desired rate, there ought to be a speedy return to reason in the manner of effective changes in the agreed rates, rules and regulations. Inasmuch as the latter is possibly too much to hope for at once, you are at least earnestly requested to give the assurance first hereinbefore requested, and to fail not in observing it.

Yours respectfully, J. W. Midgley,
Commissioner.

Some exceptions have been taken to this letter by some of the officials to whom it was addressed, on the ground that the commissioner was employed to administer the agreement, not to lecture the members on the subject of railroad ethics; but the exception is not well taken. The proper administration of such an agreement is possible only through the adherence to its terms by all the parties connected therewith, and one of the most important functions of the commissioner is to call attention to infractions of the agreement. If any fault is to be found with the letter in question and with others that have preceded it, it is that violations have not been characterized in sufficiently severe terms. It is to be presumed that the agreements are made in good faith, and it is at least supposable that the moral sentiment of a large majority of the members would be sufficiently strong to sustain the commissioner in the severest criticism of those who violate its terms. It is only to be regretted that his position is such as to make it impossible to use such language as was employed by J. Pierpont Morgan just previous to the formation of the Joint Traffic Association at a dinner given to the presidents of the roads. He is reported to have said:

In all of the rate wars the traffic managers and general freight and passenger agents have been blamed for cutting rates. This to me is nonsense. The head of the railroads, the presidents, are to blame for rate cutting. You cannot tell me that your subordinates would cut rates unless you authorized them to do it.

Now I represent the financial backing of your roads. I shall in the future hold you responsible for rate cutting. If you do not stop it, why I will see that your directors get somebody that does.

It may be that the situation in the west precludes the possibility of making such a threat effective, but no one intimately acquainted with railway methods but knows that Mr. Morgan was right in his premises. His proposed remedy is more drastic than wise, but his location of the difficulty is accurate.

What will be the next step of the western roads is impossible to tell. If they are wise it will be an effort to get all of the roads in the country into line for an amendment of the interstate commerce law, during the coming session. The lukewarmness manifested by certain eastern roads when the subject was last under consideration in congress, should be overcome, and the strongest possible influence be brought to bear to obtain a favorable consideration of such an amendment during the coming session. Minor issues should be, for the time being, ignored, and the main question pressed to a conclusion.

The Southern & Southwestern Railway Club.

The next meeting of the Southern & Southwestern Railway Club, will take place at the Kimball House, Atlanta, Ga., on Thursday, Nov. 19, 1896, at 10 o'clock, a. m. The following subjects were selected for discussion:

1. "Piece Work for Car Repairs." Special committee—Messrs. A. B. Corinth, G. D. Harris, R. P. C. Sanderson.
2. "Weakness and Failures of Side and End Freight Car Doors." Special committee—Messrs. E. M. Roberts, S. A. Charpiot, R. P. C. Sanderson, W. H. H. Price and James Cullen.
3. "Ratio of Grate Area, Heating Area and Cylinder Volume." Special committee—Messrs. E. Burton, F. E Tubbs, O. G. Cheatham. This committee is to present to the club a tabulated report secured by the use of a general form, such as they may select, filled in by members giving measurements of as many engines as possible, which are considered as satisfactory in these respects, giving cylinder capacity, data in regard to flues and other desirable dimensions.

The standing committee on M. C. B. rules consisting of Messrs. R. P. C. Sanderson, J. M. Holt and S. A. Charpiot will report at the April meeting. In the meantime members are requested to communicate to the committee all points of the present rules that appear obscure, or out of which any trouble arises.

The executive committee has also selected Messrs. A. T. Hooker, P. H. Schrieber and W. A. Love, as a special committee to report at the January meeting, on "Uncoupling Arrangements for M. C. B. Couplers." This committee is to communicate with members for information as to the weakness and failures of present uncoupling appliances now in use with M. C. B. couplers of different makes, to review the information received, and to make recommendations to the club at the January meeting.

Messrs. J. E Worswick, J. T. Robinson and T. B. Irvin were selected as committee to watch the practical workings of the recently adopted recommended practice for loading lumber, and report with recommendations for improvements or changes if desirable, at the January meeting of the club.

Messrs. W. H. Owen, O. B. Bidwell and J. B. Michael were selected as a special committee on "Trains Parting," Members are requested to bear this matter in mind and to get reports of accidental parting of trains, equipped with M. C. B. couplers, giving cause of failures and name of couplers, and to forward information to committee, who will review, tabulate and make recommendations at the meeting of the club in April.

Messrs. C. F. Thomas, F. H. McGee, H. A. Gillis were appointed as a special committee on "Exhaust Pipes." The committee is to arrange for patterns to be made for exhaust pipes and nozzles for engines of large power and capacity, 19 or 20 in. cylinders; patterns conforming accurately to recommendations made by M. M. committee, at convention of 1896, Robert Quayle, chairman. The committee is to correspond with members and arrange for as many tests of these exhaust pipes as possible the data to be kept in some prescribed way and to collect information as to fuel, water, and free running qualities as compared with other engines of same class equipped with the standard device of the road making the experiment. Committee to report at the club meeting of April.

Messrs. James Magleen, Wm. Anderson and Jas. F. Blackwood, selected as a committee on "Painted vs. Planished Iron for Jackets." The committee is to collect information in regard to the experiments now going on in this line, and to report as to relative cost and appearance at the January meeting of the club, and to make a subsequent report as to wearing qualities at the April meeting of the club.

At the November meeting, which is the annual meeting, the election of officers for the year 1896-7, will take place; after which a dinner will be partaken of by the members of the club and invited guests.

PAST AND PRESENT TENDENCIES IN ENGINEERING EDUCATION.*

Thirty years ago the public opinion looked with distrust upon technical education. Its scientific basis and utilitarian aims were regarded as on a far lower plane than the well tried methods of that venerable classical education whose purpose was to discipline and polish the mind. What wonderful changes of opinion have resulted, how the engineering education has increased and flourished, how it has influenced the old methods, and how it has gained a high place in public estimation, are well known to all. Engineering courses of study a quarter of a century ago were scientific rather than technical. It was recognized that the principles and facts of science were likely to be useful to the everyday work of life and particularly in the design and construction of machinery and structures. Hence mathematics was taught more thoroughly and with greater regards to practical applications, chemistry and physics were exemplified by laboratory work, drawing was introduced, and surveying was taught by actual field practice. Although engineering practice was rarely discussed in those early schools, and although questions of economic construction were but seldom brought to the attention of students, yet the scientific spirit that prevailed was most praiseworthy and its influence has been far reaching.

This scientific education notably differed from the old classical education in two important respects: first, the principles of science were regarded as principles of truth whose study was ennobling because it attempted to solve the mystery of the universe; and second, the laws of the forces of nature were recognized as important to be understood in order to advance the prosperity and happiness of man. The former point of view led to the introduction of experimental work, it being recognized that the truth of nature's laws could be verified by experience alone; the latter point of view led to the application of these laws in industrial and technical experimentation. Gradually the latter tendency became far stronger than the former and thus the scientific school developed into the engineering college.

The very great value of laboratory experiments, and of all the so-called practical work of the engineering

*Abstract of presidential address by Prof. Mansfield Merriman before the Society for the Promotion of Engineering Education.

school of to-day, is granted by all. Principles and laws which otherwise may be but indistinct mental propositions are by experimentation rendered relics of nature. The student thus discovers and sees the laws of mechanics, and is inspired with the true scientific spirit of investigation. It should not, however, be forgotten that if such practical work be carried beyond the extent necessary to illustrate principles it may become a source of danger. The student of average ability may pass a pleasant hour in using apparatus to perform experiments, which have been carefully laid out for him, and yet gain therefrom little mental advantage. Especially is this true when the work assumes the form of manual training which, however, useful in itself, is properly considered by many as of too little value to occupy a place in the curriculum of an engineering college.

The tendency toward the multiplication of engineering courses of study has been a strong one, especially on the part of the public. This has resulted in a specialization that, as a rule, has not been of the highest advantage to students. In some institutions this has gone so far that the student of civil engineering learns nothing of boilers and machines, while the student of mechanical engineering learns nothing of surveying or bridges. The graduate is thus too often apt to lack that broad foundation upon which alone he can hope to build a successful career.

The length of the course of study in engineering colleges has generally been for four years, and whatever tendencies have existed towards a five-years' course have now for the most part disappeared. With higher requirements for admission, particularly in English and in modern languages, a reduction of the length of the course to three years may possibly be ventured in the future, particularly if the long summer vacation be utilized for some of the practical work, as indeed is now the case in several institutions.

The report of the committee on requirements for admission, which will be presented later in the session, sets forth many facts which show the tendencies now existing. Almost without exception a higher standard is demanded, both that students may enter with better mental training, and that more time may be available in the course for technical subjects. While the general line of advance is toward an increase in mathematics and in modern languages, there is also found, particularly in the central states, a demand for broader training in science. It has already been pointed out that our early engineering schools were strong in scientific training, and that the tendency has been to replace this by industrial application. If the requirements for admission can be extended te include the elements of chemistry and physics, with some botany or zoology, the engineering student will enter with broader views, a keener power of observation, and a scientific spirit, that will greatly increase his chances for success in technical studies.

The general increase in requirements for admission tends to raise the average age of the student. It is now usually the case, owing to the greater length of time needed in preparatory work, that the average age of the classical student is one year higher than that of the engineering student; or the former has had one more year of training than the latter. One more year of training means much as an element for success; one more year in age means an increase in judgment, which is of the highest importance for a proper appreciation of the work of the course. The older men in a class usually do the best if not the most brilliant work, and after graduation their progress is the most satisfactory. It thus appears that all tendencies that raise the age of entrance are most important ones and deserve hearty encouragement.

Mathematics is undoubtedly the most important subject in all courses of engineering study, and it has been demanded for years that it be taught with great thoroughness. This demand has been met more completely in the independent engineering colleges than in the engineering courses of the universities. Much, however, remains to be done in this direction, and probably it cannot be satisfactorily accomplished, until a change in method has been effected. The fundamental element in the change of the method must be, it seems to me, in a partial abolition of the former logic of the text books, and an introduction of historical and utilitarian ideas. Mathematics is a tool to be studied for its uses, rather than for its logic or for the discipline that it can give; hence let its applications be indicated frequently and not be systematically kept out of view. If the student gains the impression that his mathematical exercises are merely intended to train the mind, his interest and his progress will usually be slow. If, however, he learns what mathematics has done in the past, how it joins with mechanics to explain the motions of the distant planets, as well as to advance the material prosperity of man, there arises an interest and a zeal that helps him to overcome all difficulties.

Next to importance in mathematics comes mechanics, the science that teaches the laws of force and motion. In most institutions the rational is separated from the applied mechanics and often taught by the mathematical department. Probably less improvement has resulted in the teaching of rational mechanics during the past quarter of a century than in any other subject. That mechanics is an experimental science whose laws are founded on observation and experience is often forgotten, and the formal logic or the text books tends to give students the impression that it is a subsidiary branch of mathematics. The most interesting history of the development of the science is rarely brought to the attention of classes, and altogether it appears that the present methods and results are capable of great improvement.

Physics in some colleges is given in five or six exercises per week, extending over a year, while in others the elements are required for admission and the regular course is correspondingly abridged. The marvelous development of electrical theory and practice has naturally tended to make this the most important topic in the course, sometimes indeed to a material abridgment of mechanics, acoustics, thermodynamics and optics. Considering how great is the importance of each branch of physics and the advances that are made every year in new directions, it may also be concluded that more time can be profitably given to both theory and to experimental work. Physics is a fundamental subject whose principles and results are of constant application in every walk of life, and a student who thoroughly covers a well arranged course has gained a mental discipline and a scientific habit of mind that will be of greater value than the technical details of a purely engineering specialty.

Undoubtedly the most powerful tendency in engineering education has been in the direction of the development of those technic subjects which may be grouped under the name of construction and design. In civil engineering this has led to plans for railroad water supply, and bridge constructions; in mechanical engineering to engine and machine design, in mining engineering to projects for mine plants, and in electrical engineering to the design of dynamos and motors. These courses have been demanded by the public and by the students themselves, and have been often elaborated to an extent beyond the best judgment of teachers of engineering. To the extension of such courses there is no limit, but it is a question whether the process has not already gone too far. For instance, it would not be difficult to arrange a course of twenty or thirty exercises on water pipes in which should be discussed all the methods of manufacture and processes of laying cast iron, wrought iron lap-welded, steel riveted, and wooden mains, together with a comparison of their relative economies under different conditions in different parts of the country. These lectures, however, would plainly be of such a technical nature that the advantage to the student would be slight; they would give valuable information but little training.

In all courses in construction and design the practical limit seems to be reached when the exercises are of such a nature as to give mere information and little scientific training. The aim of all education, and of engineering education in particular, should be to render the student conscious of his mental power and sure of applying it with scientific accuracy so as to secure economy of construction. Fundamental principles are hence more important than the details of a trade, and all exercises in design should be arranged so that the student may think for himself rather than blindly copy the best practice of the best engineers.

The subject of applied mechanics, which occupies an intermediate place between rational mechanics and the work in design, has been so differentiated that the mechanics of materials is now almost the only topic common to all engineering courses. The strongest line of development has here been in the introduction of testing machines and in the making of commercial tests. This work is of high value, although it may be doubted if the use of one or two large testing machines is as advantageous as that of many smaller ones which are designed especially to illustrate principles. The student of the present day enjoys, however, advantages that were unknown a quarter of a century ago, and the marked progress in applied mechanics, from both the scientific and technical point of view, is a source of congratulation.

English and modern languages are generally called culture subjects, and it is well known that of all the topics in the engineering course these are the ones in which students have the least interest. The great importance to an engineer of being able to clearly and correctly write his own language can scarcely be overestimated. Further it may be said that no engineer can hope to attain eminence unless he can read German and French literature. In the ideal engineering colleges of the future, perhaps these subjects will be required for admission, as is now done by at least one institution, but at present they must generally be taught. The main line of improvement to secure better results will be, it seems to me, in partially abandoning the idea of culture and placing the institution upon a more utilitarian basis. If English be regarded as a means to an end instead of linguistic drill, if the aim of teaching French and German be to read fluently the language of to-day instead of laboriously to decipher the meaning of the poets of centuries ago, true zeal on the part of students will arise and a truer culture will result.

At the close of the college course the student presents a thesis showing his ability to apply the principles and rules of engineering in the investigation or design of a special problem. The tendency has been strong to abandon subjects which involve mere description or compilation, and to insist upon those that will require the student to exercise his own powers. Thus the value of the work to the student has been greatly increased, and the theses of each class are a source of stimulus to the following ones. Although the view held by some that theses should be monographs setting forth important conclusions of original investigations, is one that cannot in general be realized, it is a gratification to note that each year a few theses are produced which are sufficiently valuable to warrant immediate publication.

Occasional lectures to classes by practical engineers have been introduced in many institutions during the past decade, and with uniformly good results. In engineering education there is no conflict between theory and practice, and every professor cordially welcomes distinguished engineers to explain their great structures and achievements to his classes. It is an inspiration to students to see and hear those men who have so successfully applied sound science to economic construction, and whose influence has been uniformly to elevate the standard of the profession.

After four years of the work the engineering student receives his degree and is ready to begin his actual work of life. What the letters are that designate the degree is a matter of small importance. Moreover, if we examine the list of the alumni who graduated ten or fifteen years ago, the conviction arises that their particular course of engineering study has not been an absolute factor in determining their actual line of engineering work. It is found that graduates in civil engineering are engaged in mining, in machinery and in electricity, and that graduates in other courses are employed upon work in in which they received no special technical instructions. Thus it appears, also, that the particular course of engineering study is not so important a matter as students and the public generally suppose. In fact a young man thoroughly grounded in fundamental principles and well trained how to apply them, has almost an equal chance for success in all branches of engineering practice.

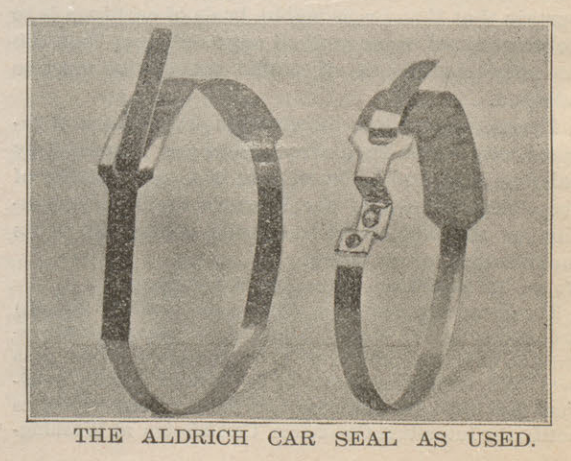
Looking now over the field of tendency thus briefly outlined, it is seen that there has been ever present a powerful impulse toward specialization, to which, indeed, nearly all others have been subordinated. This has demanded a higher standard of admission, great thoroughness in all fundamental subjects, and a rigid adherence to scientific methods. Engineering education has had an active and healthy growth. It now enjoys the respect and confidence of the public, and its future is sure to be more influential than its past. It is not specialization that has caused its success, but rather the methods which specialization has demanded. Those methods have resulted in imparting to students zeal and fidelity, a love of hard work, of veneration for the truths of science, and a consciousness of being able to attack and overcome difficulties; these elements of character are, indeed, the foundation of success in life.

Looking now forward into the future, it is seen that in our efforts for the promotion of engineering education a wide field for work still lies open. The student should enter the engineering college with a broader training and a more mature judgment. The present methods of instruction are to be rendered more thorough and more scientific. In particular, the fundamental subjects of mathematics, physics and mechanics are to be given a wider scope, while the languages and the humanities are to be so taught as to furnish that broad, general culture needed by every educated man. In general let it be kept in mind that education is more important than engineering, for the number of men who can follow the active practice of the profession will always be limited. Hence, let it be the object of engineering education to influence the world in those elements of character that the true engineer possesses, so that every graduate may enter upon the duties of life with a spirit of zeal and integrity, with a firm reliance upon scientific laws and methods, and with a courage to do his work so as best to conduce to the highest welfare of his race and his country.

THE ALDRICH CAR SEAL.

The accompanying illustrations show the Aldrich car seal which is an exceedingly simple and effective device now being manufactured in large numbers by the Aldrich Car Seal & Manufacturing Company of Detroit, Mich. The seal is made of bessemer steel, tinned. It is about 10 in. long, $\frac{1}{2}$ in. wide at the widest part and $\frac{3}{16}$ in. wide on the long narrow end. The other end is folded over along the sides for a distance of about 1 in. and forms a tube through which the small end is threaded and then passed through the small hole shown. For completing the seal these two ends are firmly clamped together by a light hand press. The seal is also bent at right angles at four different points and two small holes

THE ALDRICH CAR SEAL AS MADE.



THE ALDRICH CAR SEAL AS USED.

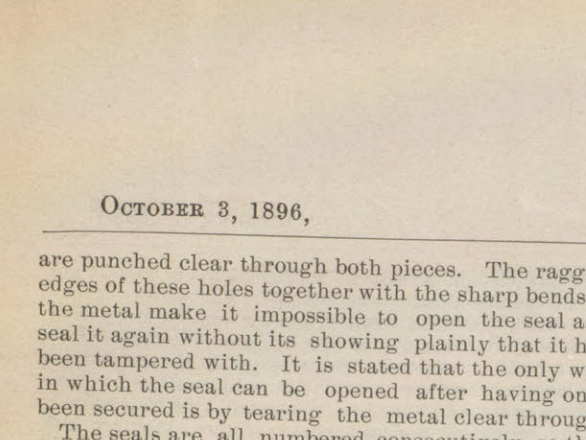
are punched clear through both pieces. The ragged edges of these holes together with the sharp bends in the metal make it impossible to open the seal and seal it again without its showing plainly that it has been tampered with. It is stated that the only way in which the seal can be opened after having once been secured is by tearing the metal clear through.

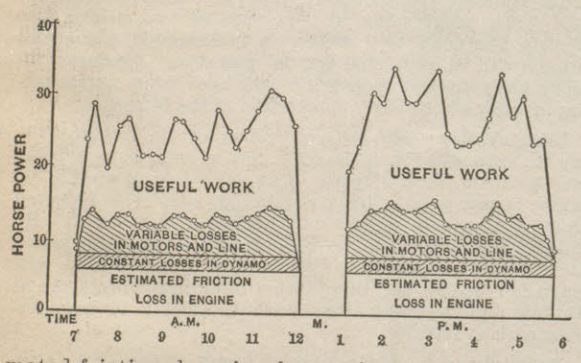
The seals are all numbered consecutively so that no two seals have the same number and therefore it is impossible to take a seal off and replace it by another as may be done when such numbers are not used or where only station numbers are employed. This method of numbering also prevents the use of a seal press by unauthorized persons who might find one that had been lost. With this method it would be impossible without detection to replace seals which have been tampered with. The figures on the seal are ⅛ of an inch in hight and are therefore easily read in making records and as such records must be kept the seal always receives inspection and the fact of its being in good condition is assured. Another advantage in the use of this style of seal is that it cannot be used for any other purpose and therefore there is no loss as with wire seals by having them used up whenever a piece of wire is wanted for some purpose when a bunch of such seals happens to be conveniently at hand. It is stated that this results in a great saving in the aggregate number of seals used.

This style of seal has been in use for about two years and the best proof of its good qualities is the fact that no report has ever been received of loss from a car sealed with one of them. This is the only kind of seal used on several of the largest railways in the country and therefore this record is a strong recommendation.

THE FRICTION OF TRANSMISSION.

The losses from the friction of transmission of power by shafting are known to be high, and wherever shafting has been used during the past few years great efforts have been made to reduce the length to the lowest possible terms. This has led to the introduct on of direct driven machines and electric motors to avoid belts and the friction of the shafting. The following diagrams taken from "The Iron Age," illustrate very clearly the advantages of electric transmission. They show the results of power tests made by the Crocker-Wheeler Electric Company in the factory of the Central Stamping Company of Brooklyn. The first shows the esti-





mated friction loss in the engine, the belts, etc., and the useful work performed during a working day. The second indicates the same loss in the engine, the constant losses in the dynamo, the variable losses in the motor and the line and the useful work In the first case the average indicated horse power was 44.1 and in the second 25.7. The total loss in the first case was 31 horse power and in the second about 13 horse power. High losses are by no means unusual where shafting is employed and there are probably many steam plants now running in which the friction is upwards of 10 per cent of the total load of the engine. A case was cited before the American Society of Mechanical Engineers a short time ago in which out of a total load of about 160.5 horse power there was a constant friction load of 11.8 per cent most of which was due to a jack shaft which might have been avoided by the use of direct connected machinery. As this loss was averaged through 23 hours the advantages of doing away with intermediate shafting is apparent even in cases where it is not possible to use electric transmission.

NOTICES OF PUBLICATIONS.

In circular No. 33 just issued by the Newton Machine Works of Philadelphia, which is not standard size, the new boring, drilling and milling machine manufactured by that company is illustrated and described. The pamphlet has 12 pages and also contains illustrations of other machines manufactured by this firm.

The Westinghouse Machine Co. of Pittsburgh, Pa , has issued a new catalog descriptive of Westinghouse gas engines and Westinghouse steam engines. This catalog gives general views of the gas engine and sets forth the most important features of its design. The new East Pittsburgh works of the Westinghouse Machine Co. are illustrated and a short description thereof is given. The Westinghouse compound, standard and junior steam engines are illustrated and their good points brought forth in a general way. The illustrations in the catalog are very good and it is of the standard 6x9 dimensions.

Messrs. Henion & Hubbell of Chicago have issued a catalog of power pumps driven by belt, electricity, gas, gasoline or water power. The catalog is handsomely illustrated with halt tone engravings and it is an excellent piece of work. This company handles practically everything in the line of power pumps and makes a specialty of those driven by belt and by electricity. These are designed for both high and low service and are turned out in all sizes running from a small house pump up to one of sufficient capacity for supplying the water works system of a good sized town. One of the novelties shown is a portable triplex electric mine pump. This pump is mounted on a small car and may be moved from point to point inside of the mine on the same track as is used for moving the coal cars. These pumps are manufactured with capacities of from 59 to 295 gal. per minute and one of the standard pumps illustrated is a general service single acting triplex, driven by belt power and made in ten sizes varying in capacity from 11 to 354 gal per minute. A general service double acting duplex dump is also illustrated and is made in only two sizes having a capacity of 480 and 707 gal. per minute respectively. Triplex stuff pumps are made in six sizes specially designed for pumping paper pulp and will handle from 3 to 26 tons of this material in 24 hours. These pumps are also used for handling thick liquids, and semi-fluids of any nature. The catalog also illustrates several city water works stations where gasoline engines are used for driving triplex pumps either direct or by belt power. This system makes a plant which is exceedingly inexpensive in first cost and one which can be operated cheaply. The company also manufactures deep well pumps and has on hand in its Chicago warehouse what is said to be the largest stock of hand pumps kept anywhere in the world. In addition to this it has a complete supply of pipe fittings and everything which pertains to that class of work.

Twenty-Fifth Annual Report of the Railroad and Warehouse Commission of Illinois.

Through the courtesy of Mr. Dwight C. Morgan, a copy of the annual report of the Railroad and Warehouse Commission of the State of Illinois for the year 1895 has been received. This is in complete form including the statistics and a revised railway map of the state. The new feature of this report consisting of the illustration of engineering construction of special interest on different important roads, has already been referred to in a previous sue. It has flexible covers bound in leather.

TECHNICAL MEETINGS.

The Technical Society of the Pacific Coast has a monthly meeting on the first Friday in each month at 8 p. m., at the Academy of Sciences building, 819 Market street, San Francisco, Cal.

The Engineers' Club of Cincinnati has a monthly meeting on the third Thursday in each month, at 7:30 p. m. at he Literary Club, 24 West Fourth street, Cincinnati, O. Address P. O. Box 333.

The Engineers' Club of Minneapolis holds its meetings on the first Thursday in each month, at Public Library building, Minneapolis, Minn.

The Engineers' Club of Philadelphia meets on the first and third Saturdays in each month, at 8 p. m., at the house of the club, 1122 Girard street, Philadelphia, Pa.

The Civil Engineers' Club of Cleveland, meets on the second and fourth Tuesdays in each month, at 8 p. m., at the Case Library building, Cleveland, Ohio.

The Association of Engineers of Virginia, holds its informal meetings on the third Wednesday of each month from September to May inclusive, at 8 p. m., at 710 Terry building, Roanoke, Va.

The Western Railway Club of Chicago, holds its meeting on the third Tuesday of each month.

The Central Railway Club meets on the second Friday of January, March, May, September and October, at 2 p. m., at the Hotel Iroquois, Buffalo, N. Y.

The Denver Society of Civil Engineers meets on the second and fourth Tuesdays in each month except July, August and December, when they are held on the second Tuesday only, at 36 Jacobson building, Denver, Colo.

The Western Society of Engineers holds its regular meetings for the transaction of business and the reading and discussion of papers on the first Wednesday of each month except January.

The American Society of Civil Engineers holds meetings on the first and third Wednesdays in each month, at 8 p.m., at the House of the Society, 127 East Twenty-third street New York City.

The Association of Civil Engineers of Cornell University meets weekly every Friday, from October to May inclusive, at 2:30 p. m., at Lincoln Hall, New York.

The Boston Society of Civil Engineers, meets monthly on the third Wednesday in each month, at 7:30 p. m., at Wesleyan Hall, 36 Bromfield street, Boston, Mass.

The Canadian Society of Civil Engineers meets every other Thursday at 8 p. m., at 112 Mansfield street, Montreal, P. Q.

The Foundrymen's Association meets monthly on the first Wednesday of each month, at the Manufacturers' Club, Philadelphia, Pa.

The Montana Society of Civil Engineers meets monthly on the third Saturday in each mouth, at 7:30 p. m., at Helena, Mont.

The New England Railroad Club meets on the second Tuesday of each month, at Wesleyan Hall, Bromfield street, Boston, Mass.

The New York Railroad Club has a monthly meeting on the third Thursday in each month, at 8 p. m., at 12 West hirty-first street, New York City.

The Northwestern Track and Bridge Association meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m., at the St. Paul Union Station, St. Paul, Minn.

North-West Railway Club meets alternately at the West Hotel, Minneapolis, and the Ryan House, St. Paul, on the second Tuesday of each month.

The Engineering Association of the South meets on the second Thursday of each month at 8 p. m., at the Cumber and Publishing House, Nashville, Tenn.

The Railway Signaling Club holds its meetings in Chicago, Ill., on the second Tuesday of January, March, May, September and November. G. M. Basford, secretary, 818 The Rookery.

The Southern & Southwestern Railway Club holds its meetings on the third Thursday of January, April, August and November, at the Kimball House, Atlanta, Ga.

The Western Foundrymen's Association holds its meetings on the third Wednesday in each month, at the Great Northern Hotel, Chicago, Ill.; secretary, S. T. Johnstone, 1522 Monadnock building.

PERSONAL.

Mr. F. G. Patterson was on Sep. 28 appointed receiver of the Altoona, Clearfield & Northern road, to sell the road and its franchises.

It is understood that Mr. J. T. Odell has resigned the position of general manager of the New England, but will remain vice president of the road.

Mr. Henry Fink, receiver of the Norfolk & Western, has been made president of the reorganized company, which is to assume control Sept. 30.

Mr. C. H. Countiss has been appointed contracting Agent of the Blue and Canada Southern lines at Chicago, with headquarters at No. 187 Jackson street.

Mr. W. W. Wentz, Jr., formerly assistant to General Manager Warren of the Great Northern, has been selected assistant general manager of the St. Louis Air line.

Mr. F. E. Lewis, of the Baltimore & Ohio, has been elected president of the Association of Disabled Employes. This organization although as yet of short duration is said to be doing a vast amount of good.

Mr. J. F. Sechler, master mechanic of the Louisville, Evansville & St. Louis, at Princeton, has resigned. He will be succeeded by Mr Frank C. Cleaver, late master mechanic of the Vandalia at Terre Haute.

Announcement is made of the appointment of Mr. James Donahue, formerly freight and passenger agent of the Kansas City, Pittsburgh & Gulf road, as general passenger agent of the St. Louis & San Francisco at Kansas City.

Mr. S. B. Hynes has been appointed general manager of the Los Angeles Terminal Company, vice Mr. William Winecup, resigned. Mr. Hynes was formerly general freight and passenger agent of the Southern California road.

Mr. Allen Cameron has been appointed assistant general freight agent of the Canadian Pacific; Mr. E. J. Coyle, chief clerk in the district passenger agent's office at Vancouver, succeeding Mr. Cameron as agent at Portland, Ore.

Mr. B. Cortlander, has been appointed district passenger agent of the Pennsylvania lines for the Baltimore district, succeeding the late Mr. S. D. Kennedy. Mr. Courtlander has been in the Long Branch district as district passenger agent.

Capt. Harry Pollett, superintendent of motive power of the Manchester & Linconshire (England) road, and his chief assistant, Mr. P. M. Clure, are now in this country, and will shortly begin a tour of inspection of several of the American and Canadian railway lines.

Mr. George Ward traveling passenger agent of the Michigan division of the Big Four, his territory including the line from Benton Harbor, Mich., to Louisville, Ky., has resigned, and the office will be abolished. Mr. Ward will accept a similiar position with an eastern road Nov. 1.

Mr. Andrew J. Poppleton, who was general attorney of the Union Pacific road from its organization until his voluntary retirement in 1888,died at Omaha, Neb. on Sept. 24. Mr. Poppleton had been blind for several years previous to his death. He was succeeded as attorney to the Union Pacific by Senator Thurston.

General Agent A. M. Tucker, of the Erie, is at a sanitarium in Dansville, N. Y., suffering from nervous prostration induced by incessant application to work. Mr. Tucker went up the lakes about two months ago and since that time has paid but little attention to railroad affairs. Mr. Tucker is nearly sixty years of age.

Mr. A. W. Dickinson, for many years general superintendent of the Missouri Pacific road, was buried at his home in Seymour, Ind., the early part of this week. Three years ago, on account of poor health, he retired from active service. He was in early days connected with the late Mr. D. F. Whitcomb in railroad service, and the two were very warm personal friends.

Mr. A. Galloway, superintendent of the Indianapolis division of the Cincinnati, Hamilton & Dayton lines, has removed his headquarters to Cincinnati, and assumed the duties of superintendent of the Cincinnati, Hamilton & Dayton from Cincinnati to Dayton, from Hamilton to Indianapolis, and the Cincinnati & Dayton branch, 172 miles in all. He also will have charge of the terminals at Cincinnati, Dayton & Indianapolis.

Colonel Joseph B. Hill, who, up to a year or so ago, was assistant general manager of the Vandalia, died at his home St. Louis, September 27, after a prolonged illness resulting from old age and the intense heat of the past summer. Colonel Hill was well known all over the country in railroad circles, as previous to his connection with the Vandalia Col. Hill was superintendent of the Pan Handle at Logansport, Ind.

Mr. George F. Tyler, the first president of the Norfolk & Western Railroad, died on Wednesday evening at his residence, No. 201 South Fourteenth street, Philadelphia, Pa., in the seventy-fifth year of his age. He had been ill for some months, and had spent part of the summer at Newport. Mr. Tyler was born in Conneticut in 1822 going to Philadelphia some forty years ago. He was a director of the Fourth street National Bank at Philadelphia.

Mr. E. P. Eyman has been appointed general agent of the Chicago & Northwestern in Chicago, the most important city agency in the gift of the company. This appointment takes effect Oct. 1. Mr. George B. Vilas, for some time past agent of the road at Kenosha, has been selected as Mr. Eyman's successor in Milwaukee. At the last annual meeting of the National Association of Railway freight agents, Mr. Eyman was unanimously elected president.

Mr. B. F. Bush, who recently retired from the superintendency of the Oregon Improvement Company, at Seattle, to enter on the duties of his new office as manager of the Northern Pacific Coal Co., with headquarters at Roslyn, was extended farewell courtesies by his old employes and fellow officers, they presenting him with a handsome gold watch and chain, with a diamond locket attached. Accompanying the gift was a signed testimonial of their esteem and hearty good wishes for his success in his new associations.

A recent move on the part of the Alabama Great Southern and the Cincinnati, New Orleans & Texas Pacific roads is the establishment of an agency at New Orleans, and Mr. L. N. Kelso has been selected as agent. Mr. Kelso's work will be altogether in the freight line. Mr. Kelso comes from Cincinnati, where for some years he has been representing the freight department of the Queen & Crescent and the Southern. He is regarded as a capable and wide awake freight man, and the local fraternity are glad to welcome him into their ranks.

Messrs. George P. Nichols & Bro. of 1325 Monadnock building, Chicago, announce their appointment as general sales agents for the western states of the J. H. McEwen Manufacturing Company of Ridgway, Pa., manufacturers of the McEwen automatic engine, simple and compound and the Thompson-Ryan generator for electric railways, power and lighting plants, belted and direct connected. This firm has had twelve years' experience in the construction and equipment of electric power and lighting plants and is well equipped for this line of work.

A circular has been received announcing the appointment of Mr. H. U. Wallace as roadmaster of the first road division of the Illinois Central, with headquarters at Chicago, in place of Mr. A. Philbrick, transferred. This change went into effect September 30. Mr. Wallace is about completing the extensive work on the Chicago terminal in connection with the new Lake Front Park improvements, which has been conducted with much skill and energy and involved difficulties which are unusual in work of similar character. Mr. Wallace's experience has been unusually varied for so young a man and he is well equipped for the important position to which he has been appointed.

As was reported last week General Manager Schaff, of the Big Four, has appointed Mr. Thomas J. English superintendent of the Sandusky division with headquarters at Springfield, to succeed Mr. Wm. Gibson, who takes service with the Baltimore & Ohio October 1. Mr. English has been connected with the Big Four for the past seven years and prior to that time he was night yardmaster at the Marion yards of the Erie road, at the same time General Manager Schaff was general yardmaster at that place. As to who will succeed as trainmaster there is still some doubt. Mr. S. A. Stack, yardmaster of the Columbus yards, and Mr. D. D. Schaff, yardmaster of the Ivorydale yards, are prominently mentioned for the place.

As a recognition of the attention received at the hands of Mr. George W. Boyd, assistant general passenger agent of the Pennsylvania Railroad during the trips to and from the national conventions at St. Louis and Chicago, the Washington correspondents presented him with a souvenir charm composed of gold and silver throughout. It consists of a circular disk, on one side gold and on the reverse silver, swinging in a frame, one-half of which is gold and one-half silver. The gold side of the charm bears the inscription, "St. Louis, June 16, 1896," inclosing the monogram "G. W. B." The silver side is inscribed, "Chicago, July 7, 1896," with the Keystone of the Pennsylvania Company in the center, bearing the monogram, "P. R. R." The buckle for the silk guard is also one-half gold and one-half silver. On the beveled edges of the gold and silver disks are the words, "To Mr. George W. Boyd, from the Washington Correspondents."

Orders issued from the office of President Marvin Hughitt, of the Chicago & Northwestern Railway Company, announce that Mr. Horace G. Burt has been appointed third vice president, with offices in Chicago. He will have general supervision of the traffic of the company from October 1. He is also appointed assistant to the president of the Chicago, St. Paul, Minneapolis & Omaha road. Mr. W. A. Gardner is appointed assistant general superintendent, with office at Chicago, Illinois. Mr. Thomas A. Lawson is appointed superintendent of the Wisconsin division, vice W. A. Gardner, promoted. Mr. S. M. Braden is appointed assistant superintendent of the Wisconsin division, vice Thomas A. Lawson, promoted. Mr. T. C. Ryerson is appointed chief train dispatcher of the Wisconsin division, vice S. M. Braden, promoted. Mr. W. A. Scott is appointed general manager of the Chicago, St. Paul, Minneapolis & Omaha, with offices at St. Paul,and the office of general superintendent is to be discontinued. Mr. James T. Clark is appointed general traffic manager of the same and Mr. W H. Stennett, auditor of expenditures, with office at 22 Fifth avenue, Chicago. First Assistant General Freight Agent Hiram M. Pearce, of the Chicago, St. Paul, Minneapolis & Omaha Railway will succeed Mr. James T. Clark as general freight agent of that road. The traffic department also is to be generally reorganized and, as reported last week, General Freight Agent McCullough, of the Chicago & Northwestern, has been appointed general traffic manager of that system, with jurisdiction over both freight and passenger departments, while Mr. Marvin Hughitt, Jr., has been appointed general freight agent, vice Mr. McCullough. In the freight department the following appointments have been announced: Mr. Edmund D. Brigham, assistant general freight agent, Chicago. Mr. Thomas S. Rattle, assistant general freight agent, Chicago, Ill. All traffic to and from the territory east and south of Illinois and Indiana state lines. Charles H. Knapp, assistant general freight agent, Chicago, Ill. Foreign traffic interchanged with connecting roads originating north and west of Chicago. Divisions of freight earnings with all roads. Mr. Burton Johnson, assistant general freight agent, Chicago, Ill. Local traffic on the lines in Illlnois, Iowa, South Dakota (south of Iroquois), and Wisconsin (except north of Fond du Lac and the Ashland division). Mr. Edward J. Seymour, assistant general freight agent, Milwaukee, Wis. Local traffic on the Ashland division and Wisconsin division north of and including Fond du Lac. Mr. Herbert C. Garvin, general agent, Winona, Minn. Local traffic in Minnesota and North and South Dakota north of Iroquois. Mr. Samuel F. Miller, general agent. Green Bay, Wis. Local traffic on the Peninsula division and Green Bay, Wis.

RAILWAY NEWS.

Altoona, Clearfield & Northern.—On application for a receiver for the Altoona, Clearfield & Northern road, the Blair county court of Pennsylvania on September 28 appointed Mr. Frank G. Patterson to that position. The outstanding liabilities aggregate $226,500, and the managers are unable to pay the operating expenses. The road was intended at the time of its original construction as the connecting link in Blair and Clearfield counties between the Pennsylvania and Beech Creek systems. This is the second time within the past two years that the road has been in the hands of a receiver. The former receivers were Samuel G. Langdon of Philadelphia and Frank G. Patterson of Altoona. The principal part of the stock of the road is controlled by Pennsylvania railroad people.

Baltimore & Ohio.—The Baltimore & Ohio R. Co. (office Baltimore, Md.,) has awarded contracts to L. B. McCabe & Bro., of Baltimore, Md., for about $80,000 worth of grading and other roadbed improvements near Martinsburg, W. Va. The main object of this improvement is to do away with the sharp curves and heavy grades around Myers' Hole, and especially to avoid the dip in the grade at the latter place. About 125,000 yds. of rock and earth will have to be removed. It is expected that it will require about five months to finish the work, but the improvement will enable freight locomotives to carry five or six more cars in a train between Cumberland and Martinsburg.

The company has also awarded a contract for the grading of the yards, etc., at Cumberland to Lane Bros., of Esmont, Va. The estimated cost of this is $40,000.

Boston & Maine.—According to the annual report of the Boston & Maine R. for the year ended June 30, there has been expended on permanent improvements $1,060,663, and for the construction account $629,957. Seven steel bridges have been erected in substitution for wooden structures, and a large number of wooden bridges of minor importance rebuilt or renewed. The work of filling trestles and pile bridges wherever possible has been continued. New passenger stations have been completed. At Manchester, N. H., an entire re-arrangement of the passenger and freight facilities has been provided for, and the work of constructing the freight house and yard is well on the way to completion. Contracts have been made for the erection at Concord, N. H., of shops of sufficient capacity for the repair and maintenance of about one-half of the road's rolling stock of all classes. The work has been commenced, and will be completed during the next year. The reconstru ction of the main line of the eastern division, between Boston and Beverly, and of the Gloucester & Swampscott branches, referred to in the last report, has been completed, and the cost, $140,870.51, included in the year's operating expense. During the current fiscal year grade crossing work has been completed and the accounts closed to the amount of $269,653.57, and this sum has been added to the construction account, and so appears in the general balance sheet. Additional work has also been carried on at a cost of $182,987.56, but as none of it is yet completed, and as settlements with the state and towns participating in the cost have not yet been made, this amount is entered under "sundry items" in the general balance sheet. This report covers a full year's operation of the Concord & Montreal R. as a leased line. The result has proved beneficial to both properties, and there is ample evidence that their union has likewise proved advantageous to the communities they serve The funded debt of the Eastern R. has been reduced to $21,565,780, and the company has no floating debt. In his address to the directors, President Tuttle says: "Taking into account the unsettled commercial conditions that have for several months prevailed throughout the country, and the consequent temporary decrease in the demand for the products of New England mills and factories, upon the prosperous operation of which your company to a considerable extent depends for its revenues, the results of the fiscal year's operation, as shown in the two next preceding pages, cannot be considered otherwise than quite satisfactory. Your directors still consider it prudent to make no present increase in the dividend rate, and have continued the policy, outlined in last year's report, of expending for necessary improvements all surplus earnings above six per cent upon the common and preferred stock, and a reasonable sum to be added to the profit and loss account."

Charleston & Western.—The name of the reorganized Port Royal & Western and Port Royal & Augusta roads is to be Charleston & Western. The following directors have been elected: Messrs. J. B. Cleveland, Samuel Thomas, Thos. F. Ryan, Henry Crawford, J. O. Fleming, J. A. P. Jordan, J. A. Brock and Avery Patten. J. B. Cleveland, Spartanburg, S. C., has been elected president; Henry Crawford, vice president, and W. A. C. Ewen, secretary and treasurer. The capital stock of the new company is to be $2,000,000.

Duluth, Superior & Western.—It is now stated that the Duluth, Superior & Western road which filed articles of incorporation with the secretary of state at St. Paul last week, is simply a reorganization of the Duluth & Winnipeg, which was recently sold at auction. It would certainly seem entirely useless for an independent company to start out and build a line to parallel the Duluth & Winnipeg, such as the line described in the articles of incorporation would do.

Elgin Joliet & Eastern.—The extension of the Elgin, Joliet & Eastern to Whiting, Ind., will be completed by the middle of October. This extension will reach the refineries of the Standard Oil Company at Whiting, and it is expected will add materially to the income of the company.

Great Northern.—Mr. Guthrie, of the firm of railroad contractors, Foley Bros. & Guthrie, which firm is building the thirty-three mile branch of the Great Northern from Halstad to Crookston, reports one-half the track laid, work progressing at the rate of two miles a day. Within the next two weeks it is expected the entire branch will be completed and in operation. Farmers all along have stacked their grain and are doing no threshing in view of the early completion of the branch.

Lehigh Valley.—The Depew branch of the Lehigh Valley R., extending from the main line at Depew to a point on the New York Central near North Tonawanda, 10 miles, is now practically constructed, and it is expected that regular train service will begin on October 15. By this route the distance to Niagara Falls and Suspension Bridge will be about nine miles longer, but the time will be made up by the elimination of all grade crossings at Buffalo and the doing away with the delay in transferring cars at Batavia.

Maine Central.—The pamphlet report of the Maine Central Railroad Co. for the fiscal year ended June 30, has just been issued and shows that the gross earnings of the company were $5,010,619, an increase of $170,857 over 1895. Operating expenses, however, increased $232.888, the increase being due chiefly to a 5 per cent increase in wages of employes, a cut of 10 per cent having been made three years ago; the laying of 6,350 tons of steel rails, an increase over last year of 3,442 tons, at an increased expense of about $71,000; and the severe freshets which prevailed throughout the state of Maine in the early spring causing an estimated damage to traffic, road bed, water ways and bridges to the amount of $85,000. Many industrial enterprises upon the line were forced to suspend operations for a longer or shorter period of time, and the

business of the road as a common carrier was seriously curtailed thereby. A large amount of work has been performed during the past year in the construction of double track, rendered necessary by the increase of business, in the replacement of wooden by iron and steel bridges and in the enlargement of station grounds and buildings. The requirements of United Stated laws as to furnishing engines and freight cars with automatic brakes and couplers caused an expenditure of more than $87,000, and will call for an estimated expenditure of $225,000 to $250,000 more.

Of the outstanding obligations of the corporation the report says: "The directors would call your attention to the floating debt of the company which has been carried for many years. It is made up of items entirely outside of the legitimate operating expenses of the railroad, consisting largely of expenditures for the purchase of real estate for terminal purposes, and expenses of construction of double track which is now going on, demanded by the increase of business, as well as extensive improvements on leased lines. The large amounts which have been expended during the past two years for new equipment, are being absorbed into the current operating expenses at the rate of $10,500 per month, or $125,000 a year, but the remainder of the floating debt upon which we have shown an ability to pay the interest before payment of dividends on stock, should not be allowed to stand in that form, but should be absorbed by an issue of stock, or in some form of bonded indebtedness. The directors, after mature consideration, have determined to fund the same in a bond secured by a sinking fund, which, by annual contributions, will amount to enough to extinguish the entire debt in twenty years, and the loan should be made large enough not only to extingush the present floating debt, but so large that bonds will be available in the treasury of the company, to complete the permanent improvements now under way and in contemplation. A loan secured by a sinking fund, will, during the year, be placed on the market, the preliminary arrangements having already been made. The advantage, which we have anticipated as likely to accrue to our system, from construction of new roads in this state during the past three years, are in process of realization, and our relations with all connecting roads are amicable and mutually satisfactory."

Montreal & Ottawa.—Construction work on the Montreal & Ottawa extension, which is being built between Point Fortune and Ottawa, is going forward. The line already completed is 23½ miles in length and the whole has been leased in perpetuity to the Canadian Pacific, which road is building this extension to accommodate a section of good farming country that may be said to be entirely without a railway, as a long distance has to be traveled, either on one side or the other, to make use of the Canada Atlantic or Canadian Pacific trains. Track has been laid for ten miles beyond Rigaud, through which place the line will run, to St. Eugene, and it is expected that before winter the line will be completed to Alfred, 45 miles further on. This direct route to the springs will undoubtedly be much appreciated by travelers, besides which there is a large traffic in the mineral water, many thousands of barrels being shipped annually. Next year this railway will be completed to Ottawa and will probably become the popular short route to that city—short, not so much in respect of the number of miles saved, but the increased speed consequent on having none but easy grades and curves, no grade, it is reckoned, being above 40 feet to the mile. The construction of the new line is under the charge of Mr. H. D. Lumsden, who is well known in the service of the company.

Munising & Western.—It is now said that the Munising & Western Railway will have its western terminus at Ishpeming, Mich., instead of at Swanzy, as originally planned. This change which was decided on last week, will give the Chicago & Northwestern system a Lake Superior terminus at Munising, offsetting the arrangement of the St. Paul system for securing a lake terminus at Marquette, through connection with the Lake Superior & Ispheming Railway.

Ohio Southern.—When the sale of the Ohio Southern road was first announced, it was currently reported that Mr. C. S. Brice would be the purchaser. It is now said that the statement is entirely without foundation and that the people who will buy the road are John Jacob Astor, of New York, and Messrs. Haskell and Richie, of Lima, and Joseph Megrue, who was until recently receiver of the road. The syndicate also owns the Lima Northern, and Mr. Astor owns the Findlay, Ft. Wayne & Western, which extends from Findlay to Ft. Wayne. Mr. Astor is president of the road, and it is to be put into a system with the Ohio Southern and Lima Northern.

St. Louis & San Francisco.—On Monday, September 28, the St. Louis & San Francisco Railway Co., file l a deed of trust for record in the office of the recorder of deeds, to secure the payment of bonds to the amount of $50,000,000. The trustees named in the deed are the Mercantile Trust Co., of New York and Paschal P. Carr, and the bonds are to be known as consolidated mortgage bonds, carrying interest at 4 per cent and payable principal and interest in gold coin of the United States of or equal to the present standard in weight and fineness. The bonds are to be 50,000 in number, each of the denomination of $1,000, and to run 100 years, from the year 1896.

Tacoma, Lake Park & Columbia River.—The Tacoma, Lake Park & Columbia River road has been sold by Col. Thaddeus Huston as master in chancery, to Mr. Stuart Rice as receiver of the Washington National Bank, the judgment creditor. Mr. Rice bid in the property for $13,000, while the banks judgment amounted with interest to about $28,000. The property consists of 12 miles of standard gage road equipped with 40 lb. steel rails. It includes no rolling stock, the cars in use being leased from the Seattle, Lake Shore & Eastern R. The sale was first set for some time in August and has been postponed from week to week since. It is said that Mr. Rice has been in correspondence with eastern men regarding the proposed extension of the road to Mt. Tacoma and the Columbia river, and that Mr. Wm. Bailey of New York, who was out there a year ago with a timber expert and a coal expert to look over the property is still figuring on acquiring and extending it. Captain C. E Clancy has been receiver of the road for nearly two years past.

NEW ROADS AND PROJECTS.

California.—A company has been incorporated in California to build a road under the name of the West Shore, between San Francisco and Santa Cruz, a distance of 80 miles. As the name indicates, the new line will follow quite closely the coast line, through San Mateo and Santa Cruz counties, touching at San Gregario and Pescadero. The president of the company is Mr. R. S. Thornton, and Messrs. K. J, Willats and Frederick Homer are secretary and chief engineer respectively. The principal offices will be at San Francisco.

During the past month a company was incorporated in California to build a road from the junction of Indian creek with Eel river to the terminus of the existing cable road operated by the Bear Harbor Lumber Co. The line will be about 15 miles in length. The incorporators are Messrs. James Hunter, Vallejo, Cal.; Thomas Pollard, San Francisco; E. J. Dodge, Alameda, Cal., and Calvin Stewart and A. B. Cooper, Fort Bragg, Cal. The capital stock of the company is $200,000, of which $100,000 has been paid in.

Kentucky.—It is now said there is no doubt that the Eastern Kentucky R. Co. operating Cannal coal mines at several points in the Carter county coal fields along the line of their road, will extend their operations very materially this fall in anticipation of a large trade and also make some very important improvements.

Some months ago, according to report, the Ohio River R. was solicited by a local board of trade to extend its line from Kenova to Ashland, and offers of all possible assistance in the securing of rights of way, immunity from suits for damage, etc., was guaranteed. The matter has been hanging fire since, but lately the road is evincing an interest in the matter and something definite may be expected in the near future.

Mexico.—A press dispatch from the City of Mexico under date of September 28, contains the following: "Frederick Bartlett of Chicago, left to-day for that city, having secured a most important railway concession; in fact, the largest since that of the Mexican Central. The charter covers 2,000 kilometers with main line and branches, and provides for a standard gage road to run from some point in the state of Chihuahua on the Mexican Central Railway westward to a point on the Sonora road, with branches running north into one of the richest mineral regions on the globe, and southward along the Pacific coast, thus insuring the development of the northwest and coasts of the republic. The line will traverse a fine timber country and open up a very extensive mineral region which is now of difficult access, and abounds in gold and silver properties, and which was recently favorably reported on by an agent of the Rothschilds who explored the states of Sonora and Durango. The region is regarded as the treashouse of Mexico, and it is believed will add a new gold producing district equaling the most famous in the world, as individual miners are now with the most primitive appatatus taking out large quantities of metal. The total exrent of the road is greater than the Mexican Central's main line, and is the only great road the government has been willing to give a charter to with subvention, which on the main line amounts to $13,600 per mile, but the necessity of the road from a commercial and strategical point of view, and desirability of opening up the northwestern portion of the country and completing the railway system, was readily discerned. Practical railway men consider that the line has excellent prospects."

Missouri.—A road is being built between Campbell and Poplar Bluff, in Missouri, by the Ward Lumber Co. It is to be a standard gage freight and passenger line, and when completed will be 30 miles in length although only 10 miles will be completed this year. Connections will be formed with both the St. Louis Southwestern and the St. Louis, Iron Mountain & Southern.

North Carolina.—An important ptoject is being organized in the vicinity of Linville, N. C., which will necessitate the building of a new road. The Linville Lumber Co. has recently purchased an extensive tract of white pine timber and proposes erecting a number of saw mills. The railroad company has already been organized with W. W. Dunham, president; A. B. Camp, vice president and general manager; S. T. Kelso, secretary, and E. H. Camp, treasurer. The railroad to be built will be eleven miles long, and the company is now surveying the route. Capital stock, $200,000.

Ohio.—It is said that an electric railway from Delaware to Newark, O., a distance of some 40 miles—is about to be constructed. The enterprise is being engineered by a rich syndicate in Columbus, whose representative, Mr. Dennis, is now in Alexandria, O., having completed to that point his canvass among the farmers along his route. This opens up an immediate outlet of farm products. The road will be equipped with regular freight cars and heavy traffic will be made a special feature. The motive power will be furnished by gasoline motors at its start.

Pennsylvania.—It is the intention of the contractors of the new Pittsburgh & Glenwood road, to have the grading all completed by the first of November. Work is being pushed rapidly and large quantities of stone cut ready for the bridges is being delivered. The new line will be a part of the Baltimore & Ohio system and will greatly facilitate the traffic of that road in and out of Pittsburgh.

Virginia.—It is reported that the Atlantic Coast Line has purchased the Petersburg Asylum road and intends extending it to Matoaca, near Petersburg, a distance of 4 miles. The company is also said to be considering the idea of building a branch in Eastern Virginia and North Carolina through the tidewater country. Mr. E. T. D. Myers, of Richmond, Va., is general superintendent of the road, and Mr. John R. Kenly, of Wilmington, N. C., is general manager.

INDUSTRIAL NOTES.

Cars and Locomotives.

—The Atchison, Topeka & Santa Fe is building at its shops in Topeka, Kan., an eight-wheel locomotive for ser vice on the Topeka and Kansas City express trains. The engine is being designed especially for speed, with a view of reducing the train time between those two cities. It will have cylinders of 17x24 in., with driving wheels 63 in. in diameter over tires. It is expected to be finished within a very few days.

—The Pullman Car Co., Chicago, Ill., it is said, will shut down the freight car department indefinitely. This will throw 300 men out of work. The cause is lack of orders. The company is just finishing the last 1,000 of an order for 5.000 freight cars for the Baltimore & Ohio.

—The demands on the Big Four shops at Wabash, Ind., for the repairs of rolling stock have been so great that it has been found necessary to increase the working hours from eight to ten each day.

—The extensive locomotive shops of the Erie Railroad at Susquehanna, Pa., have been placed upon full time instead of eight hours as heretofore. This is attributed to the heavy increase in the freight business of the road.

—The Michigan-Peninsular Car Co., Detroit, Mich., is at work on an order for 400 coal cars for the Chicago, Rock Island & Pacific Railroad.

—Two of the new dairy refrigerator cars which were built at the Altoona shops of the Pennsylvania have arrived at Columbus, O., from the east. They are numbered 67,132 and 67,109, and are the largest cars of the kind ever run on the system. They are painted a cream color and are lettered differently from the old style cars. The new fast dairy freight will be known as the Keystone refrigerator line, and like the Keystone livestock express, will be run over the western lines and the Pennsylvania Railroad on the fastest possible freight schedule.

—The Union Car Co., Depew, N. Y., is building 1,000 gondola cars for the Philadelphia & Reading Railroad Co. and 250 of various kinds for the West Shore Railroad Co.

—The Wells-French Co. has contracted to build 100 refrigerator cars for Swift & Co.

—The United States Car Co. gives notice that it will not be possible to pay the coupon on the second mortgage bonds, due October 1.

Bridges.

—Press reports state that the contract for erecting a steel bridge for the Baltimore & Ohio Railroad Co., over Little Seneca Creek, near Boyd's, has been let to the Pennsylvania Steel Co., Steelton, Pa. Work has commenced on the bridge, which is expected to be finished by December 15, 1896. The new bridge will replace a wooden structure. It will be over 400 ft. long and about 100 ft. high.

—The Eastern Minnesota is replacing its wooden trestle between Rice's Point and the depot at Duluth with a steel structure, which when finished will be over 4,000 ft. in length. The undertaking is now about one-third completed. The work will be fully half completed before the winter sets in and stops operations. The bridge is so constructed as to allow the placing of a double track when needed. The work is of the highest order. The foundations and piers are constructed of Kettle river sandstone.

—Nelson & Buchanan, Chambersburg, Pa., have the contract for the cantilever bridge over the Connequenssing river. It will be 468 ft. long with a 24 ft. roadway, and two 5 ft. sidewalks.

—Plans have been prepared for an approach for the southern end of the Central bridge in Central Park, N. Y. The improvement will widen 153d street 40 ft., giving it a total width of 70 ft.

—It is stated that the engineer of bridges of the Pennsylvania Railroad Co. is preparing plans for a 10 span steel viaduct bridge on the Phoenixville branch, near Chickering Valley station. Also that the Philadelphia & Reading Railroad is preparing plans for an iron and stone bridge at the Falls Road, Falls of Schuylkill. The board of surveys has recommended the construction of a bridge over the railway tracks at Butler street, Philadelphia, at a cost of about $100,000.

—The Reading Railroad Co. has removed nearly all of the large stones used in the masonry and foundations of the old Wister furnace in Harrisburg, Pa., and has used them for bridge abutments. Twenty years ago this furnace was one of the leading industries in that section and now only a few heaps of stones mark its site.

—The construction of an $18,000 bridge in the park is being considered by the authorities of Fall River, Mass.

—The Michigan Central Railroad Co., has prepared plans for an iron bridge to carry the railway tracks over Woodward avenue, Detroit, Mich., estimated cost, $53,000

Buildings.

—The Galveston (Tex.) Wharf Company has decided to build two additional elevators just as soon as they can be built. The secretary of the company has been instructed to advertise for plans and specifications for the two elevators—one of 500,000 bushels capacity and the second of 250,000 bushels capacity. The latter will be more of a clearing house than an elevator. The estimated cost of these two buildings is placed at $200,000, and when completed will give the wharf company an elevator capacity of 1,750,000 bushels.

—It is reported that the Central Vermont Railroad Company will soon build a new roundhouse in Burlington, Vt.

—The Whitlock Coil Pipe Company is about to remove its branch establishment from Paterson, N. J., to Elmwood. A recently authorized increase of the capital stock of the company from $75,000 to $100,000 will provide for the erection of the new building which will be of brick with dimensions of about 110x150 ft., one and one-half stories high with a pipe extension of 100 ft.

—It is stated that J. J. Hill, president Great Northern Railway, has been granted a permit to erect a 1,500,000 bushel elevator in Minneapolis, Minn.

—It is stated that the Chicago Great Western Railway Company has secured about $5,000,000 from European investors for improvements to the road, which include the erection of grain elevators in Kansas City (now under construction at a cost of $200,000); St. Joseph, Mo.; Omaha, Neb.; Leavenworth, Kan.; Topeka, Kan.; Minneapolis and St. Paul, Minn.; Buffalo, N. Y.; and probably one in Liverpool, Eng.

—The contract for the erection of the new general office building of the Norfolk & Western at Roanoke, Va., has been awarded and work will begin at once. The new building will be erected principally on the site of the old one; it will be 188 ft. long and 65 ft. wide, being the same length as the former building, but 15 ft. wider. The extreme hight of the building will be 100 ft. at the crest of roof, and 75 ft. at the eaves. In the old building there were three stories, while the new will be six stories high, including the basement.

—It is stated that J. Mills of Hamilton, has the contract to erect car shops for the Grand Trunk Railway at London Ont., and work will soon commence.

—The Portland (Me.) Company, manufacturers of boilers, has completed what is said to be the largest and best equipped foundry in that state. It is erected on the site of the foundry and is 87x203 ft. with a monitor roof 40 ft. span. A new 20 ton traveling electric crane runs the entire length of the building, and there are in addition two steel jib cranes of 10,000 lbs. capacity, one loam oven, 25x 19x10 ft. for drying the molds and a core oven 16x8x7 ft. A pickling tank is at present being constructed for pickling the castings, thus making the cleaning of them much easier.

—The Slaymaker-Barry Co.'s lock and hardware works at Connersville is making headway rapidly now that the structural material has arrived. The trusses for the main building are being rapidly placed and the building will soon be under roof. The foundry building is completed except the slate on the roof and the flooring. The contracts for the boiler and engines have been let to the Bass Foundry & Machine Co. of Fort Wayne, Ind.

—The latest additions to the Plant system of hotels, which is now being built at Clearwater Harbor on the Florida west coast, will be one of the finest of the series, and, for that matter, in the United States. The hotel is being built on an elevation 300 feet above tidewater, and at a point where a magnificent view of the harbor is given. What is known as Sand Key, an island in Clearwater Harbor, is to be improved and made a sort of water park for the benefit of the hotel. It is covered with tropical plants and palm trees, and is said to possess much natural beauty. The hotel itself will be four stories in hight and have accommodations for several hundred guests. It is 300 by 96 feet in dimensions, with broad verandas around each story. One of the special features will be a park surrounding the hotel, which will be adorned in a manner similar to the grounds at Tampa Bay. The building itself will be heated by steam, lighted by electricity, and will combine all the latest improvements for the comfort of the guests. A complete water works system will be included in the improvements, and a street railway from the hotel to the village of Clearwater, which is in the vicinity.

—A plan is on foot to locate an iron foundry at Farmer City, Ill. It is proposed to erect a number of buildings, the main one to have a 200 foot front, 50 feet wide, and three stories high. The foundry part will be 100 feet long, 60 feet wide and one story high. The entire plant is to be constructed of brick.

Iron and Steel.

—The receivership of the Pottstown Iron Co. is expected to come to an end early in October. The receivers have almost completed getting affairs of the company into shape for the control of the stockholders.

—The Pennsylvania Steel Co. received at its Steelton, Pa., mills on the day of the Maine election an order for 750 tons of steel rails, which had been withheld since the first of July, for a Maine railroad. The rails were at once turned out and shipped to their destination. This and other orders of the kind gave a bright appearance around the works. All the departments were put in operation. One casting weighing 40,000 pounds was recently poured.

—It is stated that the Buhl Steel Co., Sharon, Pa., has decided to increase its capital, for the erection of a steel mill, from $300,000 to $600,000. The company has already been chartered, with a capital stock of $300,000.

—It is rumored that M. E. Ingalls, president of the Big Four and Chesapeake & Ohio roads, is about to locate a big manufacturing plant at Kankakee. The enterprise is said to be a large rolling mill.

—The Central Iron Works, in Harrisburg, will shortly commence to roll a number of large plates at its universal mill for the new Niagara bridge will be constructed by the Pennsylvania Steel Co. The slabs for these plates weigh slightly over 5,000 lbs., and when completed the plates will be 35 ft. long, 36 in. wide and ⅞ of an inch thick.

—Every department of the Pueblo steel plant of the Colorado Fuel & Iron Co., about which sensational reports of a general shut down were recently circulated, has resumed full operation with a force of 2,000 men.

—The Penn Steel Casting Co., of Chester, is said to have broken the world's record in the casting of a 16-foot, four-bladed propeller wheel for Roach's shipyard. The weight of the casting is 11,000 lbs., and it is thought that the casting of this wheel will revolutionize the making of propeller wheels, which heretofore have been made of cast iron or brass. The metal used in the wheel will give it greater strength and make it almost impossible to break off a blade.

—The Illinois Steel Co. has suspended dividends upon its capital stock for the present, as a result of the falling off in business. The quarterly dividend for September was passed at the meeting of the directors held in New York Friday. The Illinois Steel Co. has paid no dividends since 1893 except two quarterly dividends, one of which was declared in February and the other in June. According to the report of President Gates for the year ending December 31, 1895, the gross profits amounted to $1,873,230, with net profits of $1,233,266. There was carried forward from the preceding year a deficit of $318,865, leaving undivided profits at the time the report was made out of $914,401.

—We are advised by the Gibson Iron Works of Gibson City, Ill., that the report that the works had been leased and will be put in operation in a short time is altogether false. The works have neither been leased nor gone out of business, but are in full blast and at the present time they have more orders than they can handle.

—Rumors are current that Mr. Geo. H. Bryant, western representative of Thos. Prosser & Son, has wandered from the straight and narrow path and dropped the last letter of his name as it were. We beg to announce to the friends of Mr. Bryant that not only that gentlemen, but also Mr. Thos. Prosser is convinced that it is for the best interests of the railways as well as manufacturers of this country to have Major McKinley occupying the presidental chair and state that they shall therefore cast their ballots for the republican nominee, reports to the contrary notwithstanding.

—The Cleveland Frog & Crossing Co. is just moving into a new iron building, 100x170 ft., which has been erected for that company by the Forest City Wire & Iron Co. The machinery and tools are being removed from the old buildings, and as these are modern and up to date the company now has excellent facilities for turning out a large amount of first-class work.

—At the works of the Otis Steel Co., of Cleveland, the work of improving and modernizing the plant is being pushed as rapidly as circumstances will permit, and it is intended that within a short space of time, this plant shall be at least equal, if not superior, to any in this country.

Machinery and Tools.

—Messrs. Riehle Bros. Testing Machine Co. has shipped to the Somovo Co., Nijni Novgorod, Russia, a 100,000 lb. automatic and autographic testing machine and also a specimen Miller. It has also placed 200,000 lb. testing machines at Schoen Pressed Steel Co. and Jones & Laughlins, Pittsburgh. They are building a large 300,000 lb. wire rope testing machine for John A. Roebling's Sons Co., Trenton, N. J. It reports the prospect of trade as very excellent.

—Thos. Carlin's Sons of Allegheny, Pa., is furnishing a complete plant for a scrap yard which consists of shears, engine, boiler, etc., to go to Western New York. This outfit is for working heavy and light railroad scrap to fit it for the market. They are also fitting out a similar plant for Chicago parties. Also a small shear for a Pennsylvania tin plate works.

Miscellaneous.

—John A. Roebling's Sons Co., the well known wire rope and cable manufacturers of Trenton, N. J., has entered suit against the Pittsburgh Traction Co. to recover $28,533.08, a balance said to be due for cables furnished the traction company. It is set forth in the statement that the traction company usually ordered 15,000 ft. at a time, and that from July 20, 1895, to when the road ceased using cables the bills for the same to the plaintiff company aggregated $41,870.73, upon which credit is given for $13,337.65, leaving a balance of the amount sued for.

—The Michigan-Peninsular Car Co, is one of the manufacturing concerns that is on top of the times and the conditions. Its statement for the year ending August 31 shows that quarterly dividends of 1 per cent were paid on the $5,000,000 of preferred stock, and that the interest on $2,000,000 of first mortgage bonds, $100,000 was paid. The earnings for the year were $396,571, and the surplus $96.571. The company was formed four years ago and has earned $1,458.517, as follows: 1892-3, $866,690; 1893-4, $36,024; 1894-5, $159,230; 1895-6, $396,571. The net surplus for the four years is nearly $300,000. The resources are $10,429,791, and the liabilities $10,131,273.

—The Peerless Pipe Covering Co.'s buildings were destroyed by fire September 22. The loss will reach $15,000, with $5,000 insurance.

—The Westinghouse-Boyden case will come up about the 19th at Washington, before the United States supreme court.

—The Baltimore & Ohio Railroad has awarded to Wm. Skinner & Sons of Baltimore a contract for ten large freight lighters, for use in New York harbor. Five are to be covered, and the remainder open freight lighters, equipped with heavy masts and hoisting gear. The latter are for ordinary heavy freight, while the covered lighters are intended principally for moving frozen meats, of which the Baltimore & Ohio handles an immense quantity at New York. All the lighters are 80 feet long, 28 feet wide and 8 feet deep. The entire lot is to be finished and delivered by the first of next year, and will cost in the aggregate between $40,000 and $50,000. The lighters will be among the largest ever built for harbor use. The company has also let contracts for the construction of additional yards at Cumberland and terminal facilities at Locust Point, Md.

—In a letter to the Manufacturers' Record the Stewart Contracting Co. of Columbia, S. C., states that fully 675,000 tons of stone will be required for the government work in Savannah harbor and Cumberland sound, Georgia. This is a very large contract, and several years will elapse before it will be completed.

—A suit has been brought by the Aldrich Car Seal Co. of Detroit, Mich., against the American Express Co. for $50,000 damages resulting from the carelessness of the express company. The Aldrich company was bidder for a large contract by the government for seals, but was ruled out of the competition because the express company did not deliver its samples and bids in time for the formal opening of the propositions. The Aldrich company's bid was the lowest that would have come before the treasury board, and they, therefore, feel that the express company is responsible for the loss of the business.

—Excellent reports of the business are received from the western office of the Union Switch & Signal Co., in Chicago. The following work has been completed or is in process of construction: Three plants are under construction for the Northern Pacific Railroad at St. Paul; at St. Anthony Park, 29 levers and 3 spaces; at Eustis avenue, 17 levers and 3 spaces; at the Chicago, Milwaukee & St. Paul Railroad crossing, 21 levers and 3 spaces. Material has been sold to the Illinois Central Railroad for a machine of 95 levers and 49 spaces to be located at Burnside crossing in Chicago, the work of installation to be done by the railroad company. A plant of 43 levers and 13 spaces has been completed at the junction of the Lake Shore & Michigan Southern and the Baltimore & Ohio roads, known as Clark Junction, in which electric locking has been applied in a very complete manner. At Lima, Ohio, the crossing of the Pittsburgh, Ft. Wayne & Chicago and the Lima Northern Railways, a 28 lever plant is almost completed and a small machine of 9 levers and seven spaces has been put in at Warsaw, Ohio. Besides these plants contracts have just been signed for large applications at Dolton and Calumet Park for the Hammond & Blue Island Railroad of which the particulars will be given later.

—The Whiteley Malleable Castings Company reports the following test made on 18 malleable iron couplers of the "American" pattern, selected promiscuously from a lot of 1,300 ready to ship. The test was made under a regulation drop under the supervision of Mr. Charles Dunn, representing R. W. Hunt & Co. of Chicago.

Bar No. 1—3 blows at 10 ft., 5 blows at 15 ft., head broke off. Fracture good.
Bar No. 2—3 blows at 10 ft., 7 blows at 15 ft., head broke off. Fracture showed small shrink in corner.
Bar No. 3—3 blows at 10 ft., 7 blows at 15 ft., head split through back wall. Fracture good.
Bar No. 4—3 blows at 10 ft., 5 blows at 15 ft. Knuckle broke.
Bar No. 5—3 blows at 10 ft., 7 blows at 15 ft., head broke off at stem. Fracture good.
Bar No. 6—3 blows at 10 ft., 6 blows at 15 ft., broke at back wall of head. Fracture good.
Bar No. 7—3 blows at 10 ft., 7 blows at 15 ft., head broke out at back wall. Split through center. Fracture good.
Bar No. 8—3 blows at 10 ft., 7 blows at 15 ft., back wall broke out. Head broke off at stem. Fracture good.
Bar No. 9—3 blows at 10 ft., 7 blows at 15 ft., head broke off at stem. Fracture good.
Bar No. 10—3 blows at 10 ft., 8 blows at 15 ft., knuckle broke. Bar O K.
Bar No. 11—3 blows at 10 ft., 7 blows at 15 ft., head split through back wall and broke off at stem. Fracture good.
Bar No. 12—3 blows at 10 ft., 8 blows at 15 ft., head broke off at stem. Fracture good.
Bar No. 13—3 blows at 10 ft., 8 blows at 15 ft., shank broke through liner block. Fracture good.
Bar No. 14—3 blows at 10 ft., 6 blows at 15 ft., knuckle broke. Back wall of coupler broke. Fracture good.
Bar No. 15—3 blows at 10 ft., 7 blows at 15 ft., split through liner block. Fracture good.
Bar No. 16—3 blows at 10 ft. 8 blows at 15 ft., split through back wall. Head broke off at stem. Fracture good.
Bar No. 17—3 blows at 10 ft., 8 blows at 15 ft., knuckle broke. Split through back wall of head. Fracture good.
Bar No. 18—3 blows at 10 ft., 6 blows at 15 ft., fracture good.
Average, 3 blows at 10 ft., 6.89 blows at 15 ft.